THE NATURAL HISTORY OF LACEY-KEOSAUQUA STATE PARK, VAN BUREN COUNTY IOWA

edited by Raymond R. Anderson and Richard J. Langel

Geological Society of Iowa

October 30, 2004 Guidebook 76

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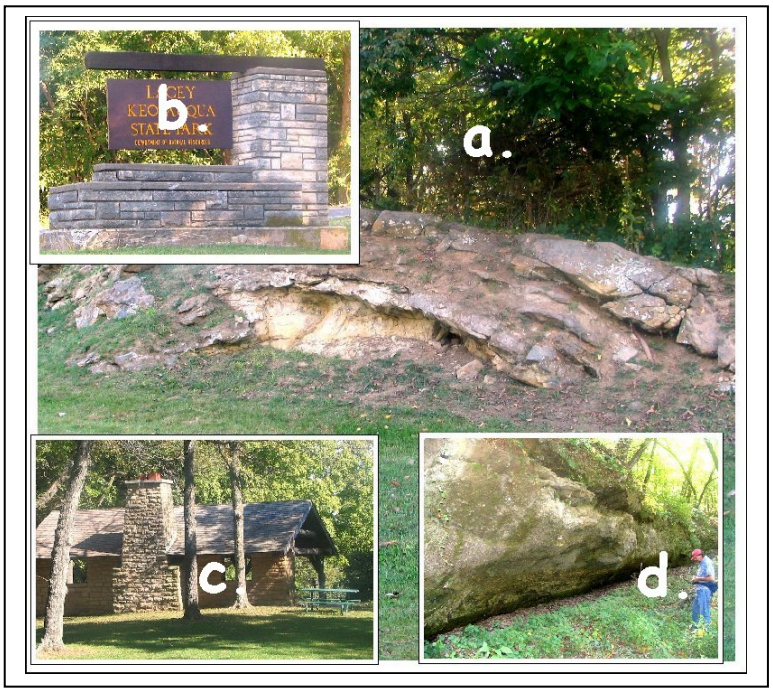

Key to Cover Photomosaic

a. Exposure of Mississippian St. Louis Fm. sandstone at east park entrance.
b. Park sign at east park entrance.
c. East shelter constructed of St. Louis Fm. dolomite.
d. Mississippian Keosauqua Sandstone exposed at Ely Ford in the park.

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The lodge at Lacey-Keosauqua State Park.

Today's field trip will visit one of the largest and most picturesque of Iowa's state parks, Lacey-Keosauqua State Park. Located in the south-central part of Van Buren County, in southeast Iowa, Lacey-Keosauqua includes 1,653 acres of hills, bluffs, and valleys along the south bank of the Des Moines River at the south end of the great horseshoe bend, a 13 mile-long meander in the river (see photo below). Lacey-Keosauqua State Park was dedicated in 1921, the second addition to the Iowa State Park System. The park is a rich repository of plants and animals, and, like the southeast corner of Iowa, it shares a long and interesting history. During today's field trip, we will examine and discuss many aspects of that history, from the tropical seas in which the park's rocks were deposited to the sea of ice that covered the region during the Pleistocene. From the Native Americans who buried their dead in mounds on the west end of the park, to the pioneers who battled the land and sometimes their neighbors to preserve their home, to the thousands of brave souls who crossed this country headed west in search of religious freedom, to the ranks of "boys," strangers to the area, who toiled in the depths of the depression to make the park accessible and useable, we will see much of this historical record within the bounds of Lacey-Keosauqua State Park.

Aerial photo of the "***great horseshoe bend"*** of the Des Moines River. Lacey-Keosauqua State Park is in the foreground.

The rock record in Lacey-Keosauqua State Park tells a tale of shallow tropical seas. Fluctuating water depths and currents deposited sands and muds, only to shift and erode them away. Then, one final deepening of the sea deposited the limestones of the Pella Formation, which were later mined in the park to produce stone for many park structures. Brian Witzke (Iowa Geological Survey) will help us to unravel this rock record today. Millions of years later, the seas once again advanced on Iowa, and we will visit one of the river valleys that flowed into that Pennsylvanian sea. We will see a variety of rounded erratic (rocks anomalous to this area, ferried from Minnesota, Wisconsin, and Canada by giant sheets of glacial ice), but we will not see any of the glacial till that should be associated with them. Where is the till? Ask Stephanie Tassier-Surine (Iowa Geological Survey).

Before Iowa became a state, the landscape in the area around Lacey-Keosauqua displayed a mixture of vegetations, with the river valleys and sideslopes heavily forested, while the broad ridge tops hosted prairie vegetation. Subsequent farming activity dramatically altered this vegetation pattern, but the park still preserves some of this record, with three distinct age classes of forestland. John Pearson (DNR Conservation and Recreation Division) will explain what these classes are and what they mean.

Large tracts of land with minimal development, such as Lacey-Keosauqua State Park, always harbor a wide variety of animals. This park is perhaps most famous for the diversity of its bird population. Jim Sandrock (1986) reported observing 166 species of birds in the park and surrounding area over a 5-year period of observing. Daryl Howell (DNR Conservation and Recreation Division) will be on hand to discuss the variety of animals in the park.

Scarlet tanager *(in breeding plumage when viewed in color).*

Native Americans lived and died in the park. Many artifacts have been discovered at the site of a native village at the west end of the park. Archaeological excavations of related villages in the area have given scientists much insight into the lives and lifestyle of these early residents. Joe Artz (Office of the State Archaeologist) will describe what they have learned about their lives and deaths, as evidenced by the 15 burial mounds in the park.

A stone monument and information display at the Ely Ford area of Lacey-Keosauqua State Park commemorates the passage of Mormon refugees, fleeing religious persecution in Nauvoo, Illinois, and heading towards new homes in the valley of the Great Salt Lake. Paul Garvin (Cornell College) will discuss the flight of the Mormons between 1846 and 1857.

C.C.C. workers did the most extensive and obvious alterations to the park in the mid 1930s. They built and improved roads and trails, constructed numerous stone buildings, bridges, and other structures, and planted and improved forestlands. I will point out many of these CCC projects as we travel around the park, especially at the bathhouse.

With the blessing of good weather, we will have a very special day in this very special place, with experts in almost all aspects of Lacey-Keosauqua State Park. I hope that you have an enjoyable, informative, and safe field trip, and special thanks to all of the trip leaders and contributors.

HISTORY OF LACEY-KEOSAUQUA STATE PARK, VAN BUREN COUNTY, IOWA

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INTRODUCTION

Lacey-Keosauqua State Park, located in the south-central part of Van Buren County in southeast Iowa, is one of the largest and most picturesque of Iowa's state parks. The park includes 1,653 acres of hills, bluffs, and valleys along the south bank of the Des Moines River at the south end of the great horseshoe bend, a 13 mile-long meander in the river.

Figure 1. West entrance to Lacey-Keosauqua State Park.

John Fletcher Lacey (1841 – 1913)

John Fletcher Lacey was born in New Martinsville, Va. (now West Virginia) on, May 30, 1841. At age 14, his family moved to Oskaloosa, Iowa, where he continued his education and learned the trades of bricklaying and plastering. In 1861, he joined the Iowa Volunteer Infantry, where he attained the rank of Major and was promoted to assistant adjutant general. On returning to Iowa, he was elected to Iowa House of Representatives in 1868, and then to Congress in 1888, where he represented Iowa's 6th district for 16 years. While in Congress, Major Lacey campaigned for conservation legislation, including the introduction of H.R. 6442, "***An act to protect the birds and animals in Yellowstone National Park, and to punish crimes in said park.***" The **"Lacey Act"** represented a comprehensive game law that limited market hunting of both mammal and bird species, and effectively ended the use of rare and exotic bird plumage for millinery purposes. Back in Iowa, Lacey was instrumental in the establishment of the Iowa state park system

"***Lacey was the first American congressman to become an avowed champion of wildlife. The proud state of Iowa may well regard John F. Lacey as one of her most illustrious men. To him, the people of Iowa, and the bird-lovers of America, owe a monument as lofty as his own purposes, and as imperishable as his fame***." --**William T. Hornaday**, prominent zoologist and conservationist, 1913.

PARK DEDICATION

Lacey-Keosauqua State Park was officially dedicated in 1921, the second of Iowa's State Parks. Edgar R. Harlan, a Keosauqua resident who served as the second director and curator of the Historical Department of Iowa, initiated development of a park in the area. Harlan organized a drive to collect funds from Van Buren County citizens for the purchase of 160 acres of land at $40 per acre, with the belief that the State of Iowa would add an additional 160 acres for the park. A total of $6400 was raised from 341 contributors, and the Iowa Board on Conservation in Des Moines agreed to purchase an additional 582 acres for a total of 1222 acres at a total cost of $46,110. The land was purchased from 17 landowners and the park was formally opened and dedicated on October 26th and 27th, 1920.

The three-part dedication program, as described by the Keosauqua Republican (1920), included a recreational fox hunt on the evening of October 26, an education program held at the Keosauqua Opera House (moved from its original park location by rain) featuring a program by Dr. Bohumil Shimek (professor of biology at the University of Iowa), Dr. George F. Kay (Iowa State Geologist), Reverend LeRoy Titus Weeks (of Emmettsburg) Dr. Charles R. Keys (former

assistant Iowa State Geologist), Professor Charles Atherton Cumming (artist and art educator at Cornell College), and Professor Pyster (of Ames). The final part of the dedication ceremony for the new state park was an inspirational program on October 27 at the Opera House, featuring Dr. Thomas H. McBride (President Emeritus of the State University of Iowa). This part of the dedication also featured the presentation of the park by Dr. L. H. Pammel (President of the Iowa State Board of Conservation) to the State of Iowa, represented by E. S. Hoyt (Treasurer of the State of Iowa). The state named H.E. Blackledge, S.W. Manning, and J. H. Strickland to serve as park trustees, and H.E. Reese was appointed as the first park custodian.

WHAT'S IN A NAME?

The area of Lacey-Keosauqua State Park was originally called "Big Bend Park," in reference to the big bend in the Des Moines River on which the area is centered. The name was apparently changed to "Keosauqua Park" (named after the nearby town of Keosauqua) for the formal park dedication. "Keosauqua" is an Indian word, which is variably translated. Fitzpatrick (1931) identified the word Keosauqua as "Indian parlance, *the river of monks*," named for a group of monks that were living along the Des Moines River near the current town. Fitzpatrick also stated that "the approximate Fox Indian word for the Des Moines River is 'Ke o shaw qua' or 'Ke ish shaw que,'(the stream bearing a floating mass of snow, slush, or ice) and from this Indian word the town of Keosauqua took its name." Alternatively, *Keosauqua-Its Early History* (2004) says that Keosauqua is the Indian term for "Big Bend."

In 1926, the name was officially changed to Lacey-Keosauqua State Park. The "Lacey" was added to the park's name to honor Major John Fletcher Lacey of Oskaloosa, a Civil War veteran, U. S. Congressman, and early naturalist (see insert on page 3). A monument to Lacey near the west park entrance features a glacial boulder with a commemorative plaque that reads, "*This boulder is dedicated to Major John Fletcher Lacey, eminent lawyer, statesman, soldier, and citizen, for his constructive work in conservation, by the Iowa Conservation Association.*"

THE CCC AT LACEY-KEOSAUQUA

Several CCC camps participated in work at Lacey-Keosauqua State Park, including DSP-2, SP-21, TP-4, and S-102, and perhaps most notably S.P.12 (more commonly known as Company 770) that worked under the jurisdiction of the National Park Service from October 1933-October 1934. During that period they constructed 3 ½ miles of crushed stone roads through the park and an extensive system of trails, including one that follows the Des Moines River for the entire length of the park. Also, the CCC workers (or "boys") constructed a large picnic shelter near the center of the park, an entrance gate and picnic shelter at the western entrance of the park, bridges over Thatcher Creek (below shelter #1) and at Ely Ford (as well as a number of smaller bridges), a golf course near the west entrance, and remodeled an existing stone house to

Figure 2. CCC work crew on the way to work at Lacey-Keosauqua State Park from their camp in Keosauqua.

be the club house (now the park lodge). They constructed a stone house for the park custodian and they installed a water system throughout the park.

LACEY-KEOSAUQUA DAM, LAKE, AND BATHHOUSE

The Dam

In 1934, CCC Company 770 created a lake at Lacey-Keosauqua State Park by damming Thatcher Creek. The company moved 44,350 cubic yards of earth, used 799 cubic yards of rock fill, 485 cubic yards of concrete with 14,200 yards of reinforcing steel, and 1,125 cubic yards of stone rip rap (Aylor, 1980) to build the dam and impound 24 acres of water, reaching a maximum depth of 30 feet at the dam. The entire 700-acre lake drainage basin is located within the park. The dam is 500 feet long, 260 feet wide at its base, and 45 feet high at its center. Shortly after the lake was filled with water, a leak was discovered. To find the leak, potassium permanganate was pored into holes drilled into the dam. The chemical turned the water bright red and the leak was discovered and repaired by grouting (Aylor, 1980). Numerous fish shelters constructed of logs and stone, and several sand spawning beds were created on the lake floor.

Figure 3. Dam (background), lake, and beach at Lacey-Keosauqua State Park constructed by the CCC in 1932.

Oscar the Dog

A stone monument located near the boat-launching ramp on the west end of the Lacey-Keosauqua Lake dam memorializes Oscar the dog. Oscar was a popular CCC mascot who apparently met his demise during construction of the dam. He was buried at the end of the dam and covered with a concrete slab in which was written "Oscar faithful little dog mascot of C.C.C. Co. 2719 killed in the line of duty January 1935." Recently the Friends of Lacey-Keosauqua erected a granite bolder monument with the same epitaph (below) next to the concrete slab.

The CCC design of the Lacey-Keosauqua Lake dam utilized only a concrete flume spillway to control lake level. By 1993, the earthen materials around the spillway had become seriously honeycombed, and the spillway was in danger of catastrophic failure. To repair this problem, the DNR, in 1995, lowered the lake level and installed a 42-inch drop structure that would pass water through a large pipe to control lake level. The lake was then refilled. All went well until Memorial Day, 2002, when a leak developed in the dam. Called to the site, DNR Fisheries biologist Mark Flammang saw water running out of a large hole that passed completely through the dam ("I could see light on the other end" – see Figure 4). As he watched the hole grew larger then eventually collapsed leaving a large notch in the dam (Figure 5). The lake had dropped 4 feet as 26.1 million gallons of water escaped

through the breach. Mark and other DNR personnel quickly pulled up the stop-block, sending lake water surging through the outlet pipe and lowering the water below the breach (saving the dam). Ultimately, the water level was drawn down another 9 feet for repair, draining an additional 57 million gallons from the lake.

Figure 4. A leak soon widened to create a hole completely thru the dam. Note the light on the lake end of the hole and the discharge pipe to the right of the water. Photo by Mark Flammang, DNR Fisheries.

Figure 5. A breach developed as the hole in the dam collapsed. In the center of the photo is the recently installed drop-down box and discharge pipe. Photo by Mark Flammang, DNR Fisheries.

The dam had washed out beside the recently installed discharge tube because a failure of the sand drainage collector installed with the pipe. Fortunately, the discharge pipe was not damaged and only slightly undermined. In 2003, the DNR received a special Legislative appropriation for the repair of the dam. Anti-seep collars were installed on the upstream and downstream ends of the outlet pipe, the undermined areas were grouted with flowable mortar, and the breach was filled and secured. While the lake level was low, DNR fisheries personnel installed additional stake beds and other fish habitat. In the spring of 2004, the lake was refilled.

The Beach

A bathing beach (Figure 3) was constructed on the west side of the lake by carving out a hillside, removing 13,000 cubic yards of earth. This work was all done by hand, since the only CCC bulldozer was being utilized in the construction of the dam. The beach was finished by planting grass in the upper parts of the slope and covering the beach area with 1 inch of sand recovered from the Des Moines River.

Figure 6. CCC bathhouse at Lacey-Keosauqua State Park.

The Bathhouse

Some of the most spectacular CCC construction projects at Lacey-Keosauqua State Park was Lacey-Keosauqua Lake, bathhouse, and associated structures. On the bluff above the beach, the CCC crew constructed a bathhouse (Figure 6) 107 feet long and 25 feet wide from quarry stone and native log beams. The central concession area was flanked on the north with a men's dressing room wing and on the south by a women's wing with showers, latrines, and washbasins. One of the most

spectacular quarry stone stairways in any of Iowa's State Parks was constructed to provide bathers with access to the beach below. A cylindrical structure for renting boats was incorporated into the stairway. Today, the bathhouse is closed, but the beach is open for public swimming, although lifeguards are no longer present.

CCC QUARRY

CCC workers opened a quarry (Figure 7) in the Mississippian Pella Formation limestone on the west bank of Wesley Creek, just upstream from the park road bridge. At the quarry site, the Pella varies in thickness from about 4 to 20 feet (erosionally thinned near the creek). This quarry, one of the best-preserved CCC quarry in Iowa, will be field trip Stop 6. To create the quarry, a thin cover of surface soil and loess was removed, exposing the rock. The stone was quarried using compressed air drills to bore a series of holes (Figure 7) in the rock layers, and then shooting the holes with dynamite to fracture the rock into pieces that were handled by the workers. Many of these drill holes are still evident in the quarry. The stones were then dressed by hand to create the sizes and shapes needed for construction. Stone from this quarry was used to remodel the golf course club house (now the park lodge), the west park entrance portals and house, the bathhouse, steps leading to the beach on Lacey-Keosauqua Lake, the boat rental structure, several bridges in the park, and numerous other structures, walks, and walls in the park. The custodian's house and two picnic shelters (Figure 8) were constructed from St. Louis Formation sandy dolomite, quarried west of the park, along Chequest Creek near Pittsburg, Iowa.

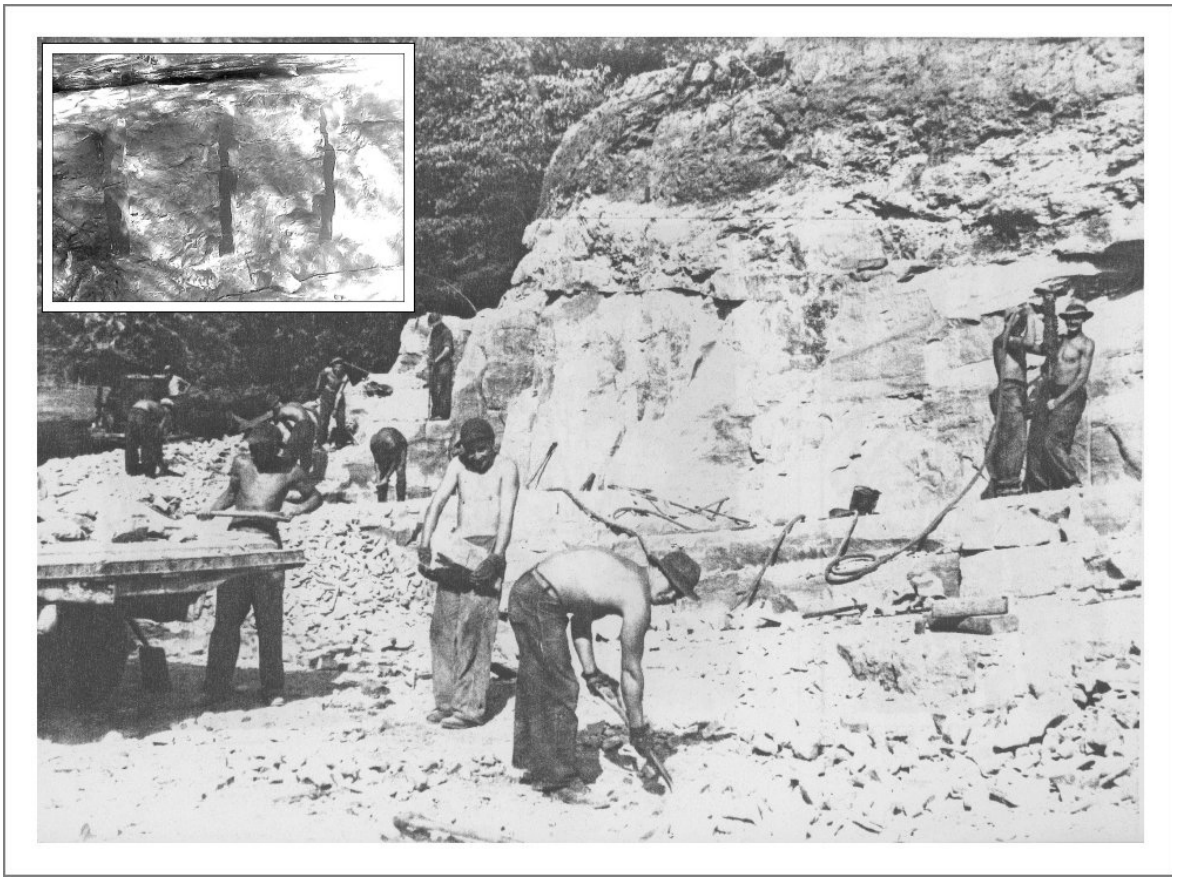

Figure 7. CCC workers removing stone from the quarry at Lacey-Keosauqua State Park. The stone quarried in the park, Mississippian Pella Fm. limestone, was used to construct several buildings, stone steps, walls, and other structures in the park. Insert shows quarry shot holes visible today.

A

Figure 8. West Shelter at Lacey Keosauqua State park was constructed of St. Louis Formation dolomite mined outside the limits of the park.

series of outdoor fireplaces, tables, and furniture were also constructed of local materials by CCC work crews, most of which have been replaced.

ELY FORD

Ely Ford is located in the western end of the park where the Des Moines River is shallow, as it runs on bedrock, and could be crossed by pioneer wagons. The area's name is derived from an early settler named David Ely, who constructed a cabin near the site in 1836. Although Ely Ford was apparently not a major crossing point for the Mormons on their trek from Nauvoo, Illinois, to Salt Lake City, a stone monument and descriptive plaque (Figure 9) marks this as a part of the Mormon trail. A more detailed description of the passage of the Mormon settlers through the area begins on page 25 of this guidebook.

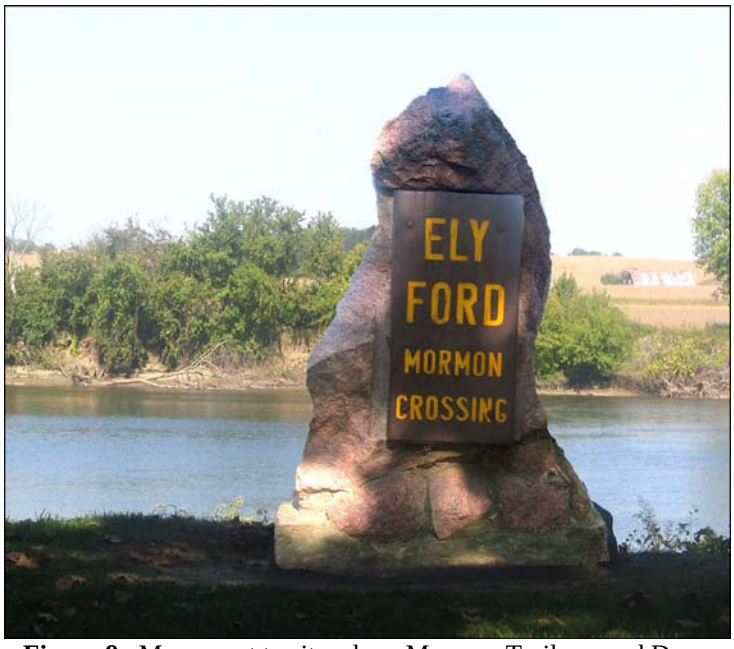

Figure 9. Monument to site where Mormon Trail crossed Des Moines River at the Ely Ford.

Ely Ford lies in the valley of Ely Creek, just north of its confluence with Duckworth Creek and the Des Moines River. Duckworth Creek is named for Duckworth's sawmill, which was located on the creek. Most of the great stands of sugar maple, black walnuts, and oaks, native to the park, were cut, cleaned, and the logs sawed into lumber at the mill.

LACEY-KEOSAUQUA STATE PARK GOLF COURSE

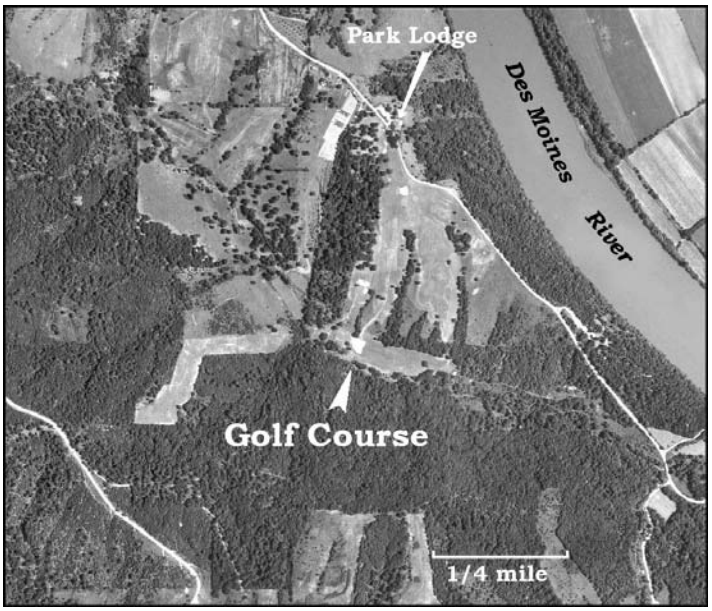

Figure 10. The Lacey-Keosauqua Golf Course is still visible as clearings in the forest in this 1941 S.C.S. aerial photo.

The Lacey-Keosauqua State Park Golf Course was organized with fifty-four charter members in May 1925. The course, located in what is now forested area south of the lodge on the west end of the park (Figure 10), was a par 34, 2710 yard, 9-hole course described as "*one of the sportiest courses in Iowa*,"(Western Historical Company, 1879). The area where the golf course was developed, on the west branch of Duckworth Creek, was once an Indian campground with abundant water, wood, and shelter, and the ability to observe enemies upriver as far as Pittsburg and downriver as far as Keosauqua. Numerous burial mounds in the area (see Artz, this volume p. 45) and the abundance of artifacts recovered by pioneer farmer Sam Jackson attest to the popularity of this area among Native American inhabitants. Jackson's stone house, located just across the road from the park golf course, was expanded by attaching a wooden house moved from elsewhere in the park. In 1931, the house was further remodelled by the CCC who added a large stone porch on the east side of the Jackson house, creating a club house for the golf course (Figure 11). The Lacey-Keosauqua Golf Course continued to operate until the late 1960s, when the golf club moved to the town of Keosauqu and constructed a new club house and golf course. Residents say that the club was moved because the state discontinued the sale of liquor at the clubhouse, although the desire for tennis courts and a swimming pool for the golf club, and the availability of federal funds were also factors. The abandoned golf course land reverted to grass and forests. Today, the tee to hole #1 is in the area occupied by a small prairie plot, just south of the lodge.

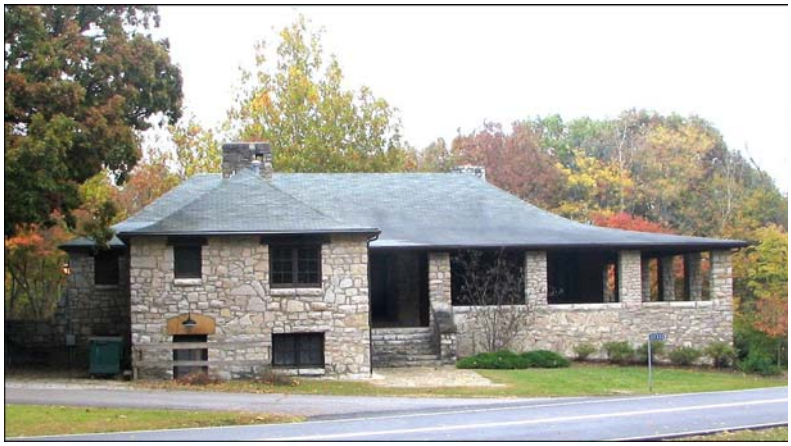

Figure 11. The lodge at Lacey-Keosauqua State Park.

LACEY-KEOSAUQUA STATE PARK TODAY

Since its dedication, Lacey-Keosauqua State Park has grown to 1,653 acres. From the original 1,222 acres, the park grew to its current size with the purchase of 10 parcels between 1934 and 1976 (Figure 12). The largest of these included 3 parcels on the eastern side of the park, obtained from J.E. Espy in 1934 and 1936, and a parcel on the southeast edge of the park, purchased from Jerry Humble in 1976. In all, 25 parcels were purchased to create Lacey-Keosauqua State Park, which is currently managed by Justin Pedretti. The roads in the park have been paved with asphalt, including Lacey Trl., which leads south out of the park and provides a principal access to Lake Suguma (see page 11)

Figure 12. Aerial view of Lacey-Keosauqua State Park looking south down Ely Ford.

Picnic Facilities

Lacey-Keosauqua has several facilities for family picnics or cookouts. Three open picnic shelters are available and may be reserved for a fee through the park manager. The picnic shelter near the east entrance of the park is ADA compliant.

The lodge may also be reserved through the park manager. The lodge is an excellent place for group events, such as wedding receptions or family reunions.

Camping

The state park includes a shaded campground with 113 campsites (45 with electrical hook-ups), modern rest rooms, shower facilities, and a trailer dump station. Camping permits are obtained by self-registration at the campground. Camping fees can be paid at the site. Additionally, the park offers 6 family cabins that may be reserved through the park manager. All cabins include modern facilities.

Trails

The park's 13 miles of hiking trails wind among the valleys and cliffs along the Des Moines River. On the trails, it is often possible to see many types of wildlife including deer, raccoons, opossums, gray squirrels, red foxes, and numerous species of bird life. The variety of plants, shrubs, and trees (some of them more than 200 years old) make hiking at the park an exciting and educational experience.

Beach and Swimming

The picturesque 30-acre lake is a favorite spot for swimmers during the summer. There is a bathhouse at the beach. Boats may be rented and a ramp provides easy access to the lake. Boating is limited to electric motors only. The lake is popular with fishermen, as is the scenic Des Moines River, which runs the length of the park

Seasonal Events and Activities

Many special activities are held at Lacey-Keosauqua State Park. The *End of Summer Cycle Rally* brings over a thousand motorcycles to the park. The *Forests Crafts Festival*, held on the second weekend of October, features woodcraft demonstrations and sales, forest and wildlife management demonstrations, and buck skinners. Also in October, the *Keosauqua Fall Festival of Colors* brings thousands of people to the park to view the fall leaf colors and attend the parade, carnival, and other related events in Keosauqua.

Lacey-Keosauqua State Park also offers winter activities such as cross-country skiing, snowmobiling, and ice fishing.

LAKE SUGEMA

Lake Sugema (Figure 13) is a 574-acre lake, constructed in 1993 by damming Indian Creek directly south of Lacey-Keosauqua State Park. Since the lake was developed primarily for recreation, extensive planning was done by the Iowa Department of Natural Resources to establish underwater structures that help fish survive and reproduce. This extensive work on fish habitat and the stocking of Lake Sugema with largemouth bass, bluegill, black crappie, channel catfish, and saugeye has produced one of the premier fishing lakes in Iowa (Figure 14). Other improvements have reduced siltation at the lake, helping to guarantee continuing good fishing. In addition to the hundreds of farm ponds, crop rotations, crop residue management and other soil saving practices that farmers have established in the lake's drainage area, the lake is protected by a series of smaller sediment-control dams.

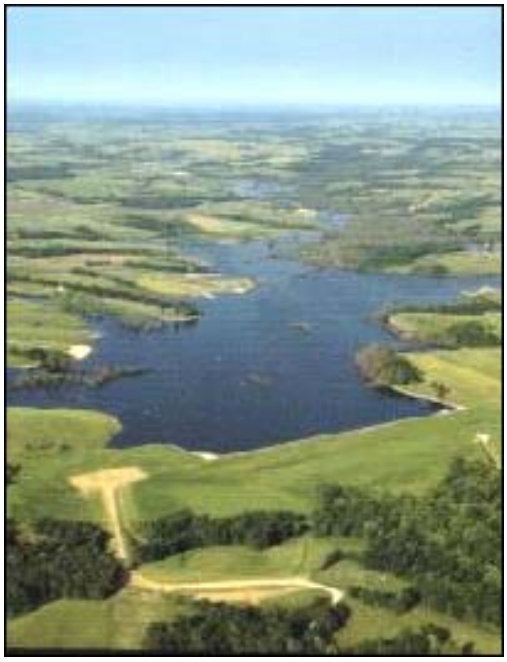

Figure 13. Aerial view of Lake Sugema.

Lake Sugema Recreation Area

The 20-acre Lake Sugema Recreation Area is located on the southeast side of the lake. A large, open shelter house, with electric outlets, boat dock facilities, and a fish cleaning station are available. A campground featuring a roofed, self-registration station and information center, an 8-site tent-camping area, 12 full-hook-up (electric, water, and sewer) asphalt-surfaced camp pads, and 10 modern (electric and water) asphalt-

surfaced camp pads (each site with a picnic table and fire ring). The camping area also includes a modern, handicapped-accessible shower house and restroom building, which is conveniently located in the campground, and a camper dump station. Seven log cabins are available for year-round-rental to interested users. A campground host (park attendant) will be on site throughout the season.

Lake Sugema Wildlife Management Area

The area immediately surrounding Lake Sugema, about 3,000 acres, was purchased by the DNR and Van Buren County to be managed as a wildlife area. That management is directed toward increasing the numbers of wild turkey, deer, squirrel, geese, quail, rabbits, songbirds, and other wild animals in the area. Habitat is also being developed for raccoon, fox, mink, muskrats, and bald eagles, among other wildlife. The Lake Sugema Wildlife area was created for public hunting, fishing, hiking, bird watching, cross country skiing, picnicking, nature study, primitive camping, and other fun in the outdoors.

The Shimek State Forest area is managed as a multiple-use area for timber products, wildlife habitat, and recreation. The 900-acre State Forest includes hiking trails and is available for public hunting.

Figure 14. Fisherman Mike Burcham won the Big Bass competition at the 1999 Lake Sugema Fishing Tourney with his 5 lbs. 1 oz. catch.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the information and references provided by the Friends of Lacey-Keosauqua State Park, especially Doris Secor, and Park Ranger Justin Pedretti. Their assistance added greatly to the continuity and the color of this discussion.

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SOME HISTORY OF VAN BUREN COUNTY AND THE TOWN OF KEOSAUQUA, IOWA

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Introduction

Van Buren County lies in the southern tier of counties, the second one from the Mississippi River. The county is twenty-four miles east and west and twenty to twenty-one miles north and south. It comprises congressional townships 67 (fractional) and 68 to 70 north, ranges 8 to 11 west. The area of Van Buren County is 482 square miles.

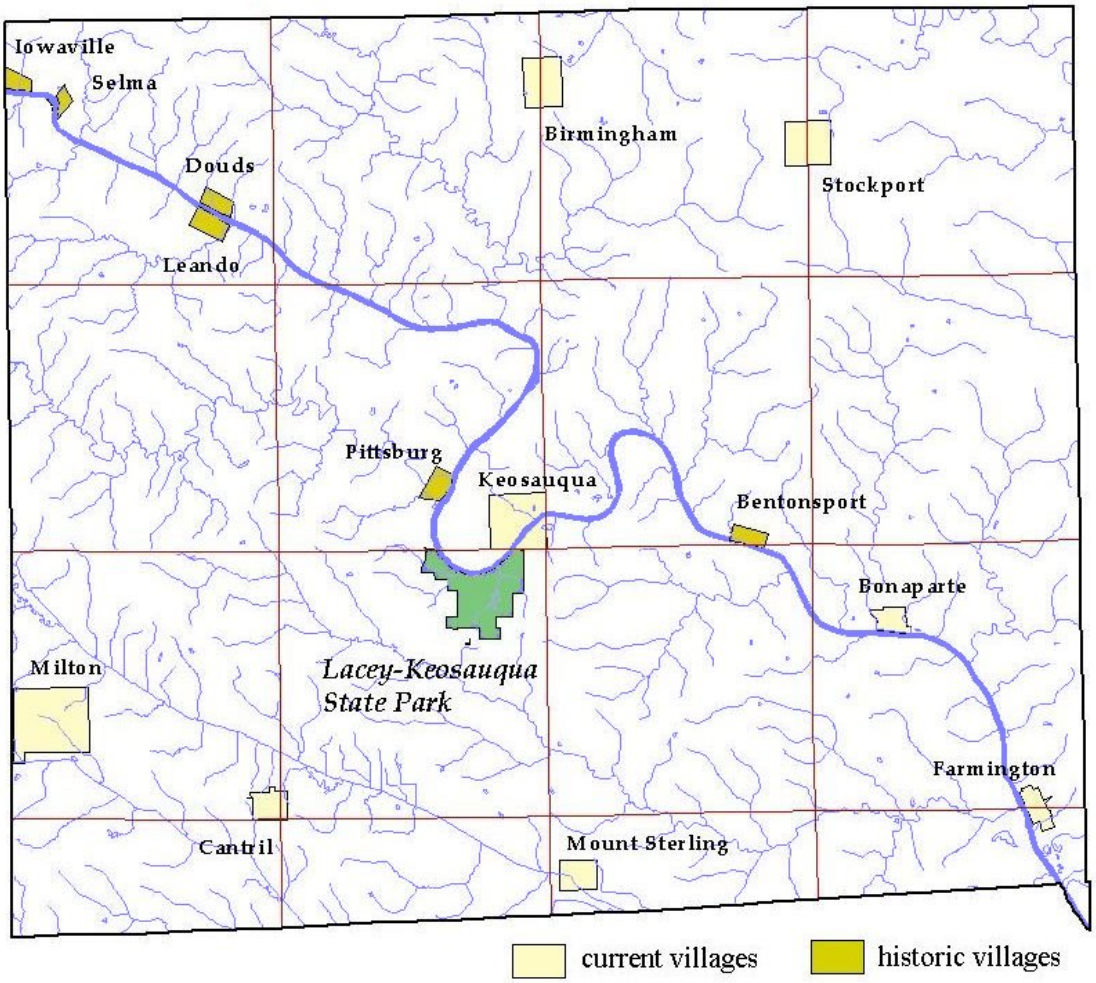

Figure 1. Map showing the 14 historic villages of Van Buren County.

Van Buren County was created by the third act of the first legislature of the Territory of Wisconsin, which met October 25, 1836, at Belmont. This act, approved December 6, 1836, divided the original Des Moines County into Lee, Van Buren, Des Moines, Henry, Louisa, and Muscatine counties. Van Buren County was named in honor of Martin Van Buren (1782-1862), who was Vice President of the United States (1833-1837) at that time. Later, he became the eighth president (1837-1841). Farmington is the oldest city in Van Buren County. It was settled

in 1833 (following the Black Hawk War and over a dozen years before Iowa's statehood), platted by Henry Bateman in 1839, and incorporated in 1841. Farmington was named the first county seat of Van Buren County.

The earliest Euro-Americans to live in southeast Iowa settled in the vicinity of Burlington. Early explorers of the area included Major Joseph B. Teas, Joseph Morgan, Colonel William Morgan, William Stewart, John Ward, Isaac Canterberg, Lewis Watters, Isaac Cranshaw, Benjamin Tucker, Ezekiel Smith and his sons Paris and Lineas, John Bullard, Richard Sand, Thomas Dovrell, David Tethro, S.S. White, M.M McCarver, Berryman Jenkins, William Wright, John Harris, and Charles Teas, all of whom were residents of Van Buren County area by the summer of 1833. However, the earliest reported non-natives to settle in Van Buren County were "some Frenchmen" who apparently inhabited the land along the Des Moines River that is now the town of Keosauqua. "Around the bend dwelt a number of monks. The Indians, discovering these places of habitation, named the section where now lies the city, Keosauqua, the meaning of which is in Indian parlance, *the river of monks*" (Van Buren County American Revolution Bicentennial Committee, 1976). (See page 4 of this guidebook for an extended discussion of the origin of the name.) Early maps of Iowa, such as Jesse Williams (1840), Colton (1844, 1852), and Wells (1857), spell the name Keosauque, a common early spelling.

In 1835, John Silvers built a claim pen of round logs near the banks of the Des Moines River, where the Manning Hotel now stands, and was soon joined by Elijah Purdom, who took a claim to the north. Purdom built a double log cabin in which the first Methodist class was organized in 1836. Later, Silvers sold his claim to the *Van Buren Company* made up of John Carnes, James Hall, James and Edwin Manning, John J. Fairman, and Robert Taylor. In 1837, this company erected the town's first building - a store kept by Carnes and Fairman. This was the first store in "Van Buren." When Fairman was appointed as postmaster, Van Buren was given the post office name of Port Oro. As postmaster, Fairman wore a high silk hat in which he kept and distributed the mail (Keosauqua-Its Early History, 2004).

By 1836, the Sac and Fox tribes had sold most of their reservation lands in what is now Tama County and moved to a new area in the Des Moines River valley in what is now Wapello County. Trading posts were soon established near the new Indian camps, and, in the fall of 1837, the first steamboat ventured up the Des Moines River, past "Van Buren" and "Des Moines" to bring trade goods to and from these posts. The boat, the *S.B. Science*, commanded by Captain Clark, reportedly fought swift currents and hidden rocks to prove that the river was navigable (Van Buren County American Revolution Bicentennial Committee, 1976). The river was further opened in 1842 when a treaty moved the Sac and Fox further west to the area of the town of Des Moines. When the government moved to establish Fort Des Moines to control the region, the steamboat *Ione* was employed to move the troops and supplies to the site of the new fort. This was the furthest into Iowa that steamboats had ventured.

In the late 1830s, the Wisconsin Territory and the State of Missouri were disputing the location of their common boundary west of the Mississippi River. When the area west of the Mississippi River became the Iowa Territory in 1838, the governor of Missouri saw an opportunity to settle the dispute to his advantage and, in 1839, he sent agents into Van Buren County to collect taxes. The confrontation that resulted is known as the "Honey War" and the details are presented beginning on page 21 of this guidebook. Congress finally resolved the border question shortly after Iowa became a state in 1846.

The Village of Keosauqua

In April 1839, the men of the Van Buren Company platted two triangular pieces of ground. The south triangle was named Van Buren and contained the church, cabin, and store. The north triangle was named Des Moines and a large brick and stone hotel and a large livery stable were soon erected in the plat. A stone gristmill was also built on the banks of the Des Moines River,

which attracted settlers from long distances. The present Hangman's Hollow was almost in the center of the Des Moines plat. Later, a diamond-shaped piece of land, lying obliquely between the triangles, was platted and joined with the Van Buren triangle. This new town was named

Figure 2. 1874 map of the Keosauqua area.

Keosauqua. But, the Des Moines plat refused to join in the union.

The first county elections were held in Farmington in the spring of 1837. That winter, the Legislature of Wisconsin passed an act relocating the county seat to Rochester. The Territorial Governor vetoed this act. An election was then held to determine the county seat, with both Keosauqua and Des Moines vying for the seat. When Keosauqua edged out Bentonsport for this honor, the settlers of Keosauqua and Des Moines assembled (one Sunday night) and decided to combine the two towns. John Carnes suggested Port Oro (a Spanish name, meaning *Port* or *Land of Gold*'), the Post Office name given by J.J. Fairman to Van Buren. Some objected to this name because it was too *high-sounding* a title for the place. Finally, Judge Irwin suggested that the town should be called by the old Indian name, Keosauqua. All agreed to it, and the matter was settled then and there.

In 1850, John Purdom established the little village of Pleasant Hill across the Des Moines River from Keosauqua. At one time, Pleasant Hill had a hundred inhabitants, a hotel, a blacksmith shop, a store, a schoolhouse, and a church. The area is now a part of Keosauqua.

Keosauqua got its first institute of higher learning in 1851 when Rev. Daniel Lane opened his first academy in the basement of the Odd Fellow's Building. The academy was closed in 1853 when Lane left to serve as principal of the Preparatory Department of Iowa College in Davenport. He returned to Keosauqua in 1859 and re-opened the academy in the basement of the old Methodist Church. The Civil War brought a slump in attendance and forced the school to close permanently.

The successful passage of the steamboat Ione up the Des Moines River, as far as the mouth of the Raccoon River, came to the attention of Congress, who passed a law in 1846 deeding large blocks of public land along the river to the State of Iowa with the idea that the state would deed the land to companies in exchange for improvement to the river to enhance navigation. The state struck an agreement with the "Des Moines Navigation and Railroad Company," giving the company 271,000 acres of land along the river in return for the company constructing a series of locks and dams. Although construction was initiated on several locks and dams along the Des Moines River, including Lock and Dam #7 (completed in 1854) just downstream from Keosauqua, the construction went slowly due to due to corruption and malfeasance. Having expended just enough money to partly complete the locks and dams along the river and gain control of the lands granted by Congress, the Des Moines Navigation and Railroad Company became bankrupt (?) and transferred its title to the "Keokuk, Des Moines & Minnesota Railroad Company." In about 1860, this company commenced the building of a railroad along the banks of the Des Moines. Three years later, the corporate name was changed to the "Des Moines Valley Railroad Company."

The dam at Keosauqua did not last long. In 1857, an ice jam destroyed the dam and dislodged several mills in Keosauqua from their foundations and rafted them down the river. In 1872, the dam at Keosauqua was replaced, only to be destroyed again during the flood of 1903. This time the dam was not repaired. In 1977, the remains of the dam at Keosauqua, along with the remains of Lock and Dam #5 at Bonaparte, were added to the National Register of Historic Places.

The Van Buren County Courthouse

By the late 1830s, the number of settlers in the country surrounding Keosauqua was growing rapidly and the town quickly became a trading center. On January 25, 1839, the Wisconsin Territorial Legislative passed an act that continued Keosauqua's position as the county seat, but only if it provided $5,000 worth of land or materials toward the construction of a Van Buren County courthouse. After several debates and changes, the final contract was awarded to Edward Manning. Construction of the courthouse dragged on for several years. In 1842, Keosauqua was incorporated by an act of the legislature as the county seat, and, in the fall of 1843, the courthouse was finally completed, at a total cost of $6,712. When completed, the building was considered one of the largest and most beautiful in the state. The structure continues to be used, and Van Buren County has the distinction of having the oldest county courthouse in use in Iowa, and the second oldest in the nation. A tower that rose 16 feet above the roofline was originally part of the courthouse, but for safety reasons it was taken down several years ago (Van Buren County Iowa, A brief History, 2004).

Figure 3. Van Buren County courthouse, constructed in 1843, is Iowa's oldest.

The Van Buren County courthouse has recently undergone several improvements. Installing long truss rods through the building strengthened it. The old mortar was replaced, and waterproofing was applied to the bricks. The old heating stoves that were used for 102 years were

replaced by a modern heating system, and new storm windows were installed. The original county office building, which was located next to the courthouse, housed the offices of the treasurer, clerk of court, sheriff, and the county superintendent of schools. This county office building was destroyed by a fire in the winter of 1896.

The Manning Hotel

One of the worst fires in Keosauqua history occurred in the1890s when the Manning and the Jackson brick blocks were destroyed, with damage estimated at $35,000. In the same year, Edwin Manning began erecting the Manning Hotel. The hotel was erected on the location of the cabin built on the first claim staked by John Silvers in 1835. Manning had originally constructed the two-story brick Edwin Manning's Mercantile store on that site in 1839. The store was expanded to include a bank in 1854, but then it was destroyed by the 1890s fire. The first floor of the Manning Hotel was constructed on the foundation of the old Mercantile, then, between 1897 and 1899, a second and third floors were added and the interior rebuilt to house the hotel and restaurant. Then, on the evening of April 27, 1899, more than 300 guests gathered for the new hotel's inaugural ball and "tripped the lights fantastic" to the strains of Schubert's Mandolin Orchestra of Ottumwa. When the floodwaters rose to a height of nearly seven feet in the flood of 1903, boats conveyed the hotel guests across the lobby to the stairway, and tied up at the banisters. The Hotel Manning was added to the National Register of Historic Places in 1973.

Figure 4. 1906 photo of Hotel Manning.

The Pearson House

Between 1845 and 1847, Benjamin Franklin Pearson, a builder and skilled stonemason, constructed a fine brick and stone house in the west part of Keosauqua. He had intended to build the entire house of stone. But after erecting the first story, he accepted a quantity of brick as payment on a debt, so he used the brick to complete the house. The second floor was originally constructed as one large room to used for Methodist Church services. Known as the Pearson House, the structure became a station on the Underground Railroad, the dramatic escape route for slaves fleeing their captors in the southern states. A hide-away under the floor was reached through a trap door. Today, the Pearson House is owned by the Van Buren County Historical Society and it was named to the National Register of Historic Places in 1977.

Figure 5. Pearson House.

The Twombly Building

Another Keosauqua building on the National Register of Historic Places served as the town's post office after 1912. The building, known as the Twombly Building, was constructed around 1875, but records of who constructed it are not clear. The structure is named after Voltaire P. Twombly, winner of the Congressional Medal of Honor for leading a Union charge in the Civil War Battle of Fort Donelson. Tradition holds that Twombly constructed the building. Historical records seem to refute that idea, but do suggest that Twombly probably was the first occupant.

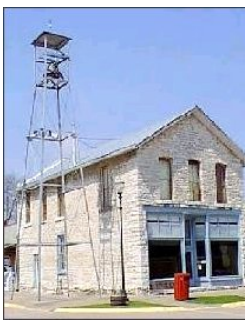

Figure 6.
Twombly Bldg.

He ran a grocery store downstairs and the Keosauqua Republican newspaper was printed on the second floor. Twombly sold the building in 1892, and a clothing store moved into the ground floor. Later, it housed a bakery and was a source of supply to Kelly's Army, a branch of Coxey's Army. The "Army" was composed of unemployed men who were traveling to Washington D.C. to protest their unemployment during the Depression of the 1890's and encourage government work programs. The men were considered rowdy and were not allowed to get off the boats at Keosauqua, so local merchants supplied food to the boats. By 1912, the building housed the post office on the first floor and a telephone company on the second floor. Today, the building houses the Van Buren County Historical Society.

The two-story rectangular building was constructed of native limestone with rusticated surface measuring 50 by 25 feet. The largest blocks are 10 inches high by 18 inches wide by eight inches deep and were placed in corners. There is evidence that the windows were added later. The Twombly Building was named to the National Register of Historic Places in 1993.

The Bridge over the Des Moines River at Keosauqua

Prior to the construction of a bridge, a ferry was used to cross the Des Moines River at Keosauqua. The ferry was operated by a cable, one end of which was attached to a point near the present location of the Manning Hotel. There was little current to operate the ferry because of the construction of dam just below the town. The ferryman had to use a rope, in addition to the cable, and frequently called upon his sturdiest passengers to help pull the ferry across the river. At other Des Moines River locations, such as Pittsburg, a strong current could carry a ferryboat across in two minutes, but the crossing at Keosauqua took much longer. At Keosauqua, there was also a small car attached to the ferry cable by a set of pulleys. Two or three could ride across the river in this car, which crossed the river more than half way by gravity, and was pulled on the cable the rest of the way.

In 1850, work commenced on the first bridge across the Des Moines River at Keosauqua. But, this bridge project was abandoned in 1851 when a portion of it fell into the river, leaving Keosauqua citizens with a $6,000 bill.

Figure 7. 1873 Keosauqua bridge.

In February 1873, the Van Buren County Supervisors contracted with the Wrought Iron Bridge Company of Canton, Ohio, to initiate construction of a major wagon bridge over the Des Moines River at Keosauqua. This bridge faired better than its predecessor, and was completed by that fall. The bridge performed well, carrying a heavily traffic load for 65 years. However, as the cars grew larger and the trucks heavier, the original bridge began to show wear and tear, and was proving too narrow for the modern vehicles.

Figure 8. The current bridge over the Des Moines River at Keosauqua was completed in 1939.

In 1938, the Iowa State Highway Commission designed a new bridge, utilizing the original stone abutments and piers. With federal funding assistance, a contract for the new bridge was awarded in August 1938 and was completed in 1939 for a cost of $86,141. The 1039 trusses are technologically significant for their uncommon Warren web configuration. It is not known how many bridges of this design were built in Iowa, but the Keosauqua bridge is the only polygonal-chorded Warren remaining in Iowa today, and as such it was added to named to National Historic Register in 1998 (Villages of Van Buren County, 2004). It must be noted, however, that the Iowa Department of Transportation has proposed replacement of the historic Des Moines River Bridge at Keosauqua. An environmental assessment was completed for the project, and it and the bridge project were discussed at a public information meeting April 27, 2004.

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THE HONEY WAR

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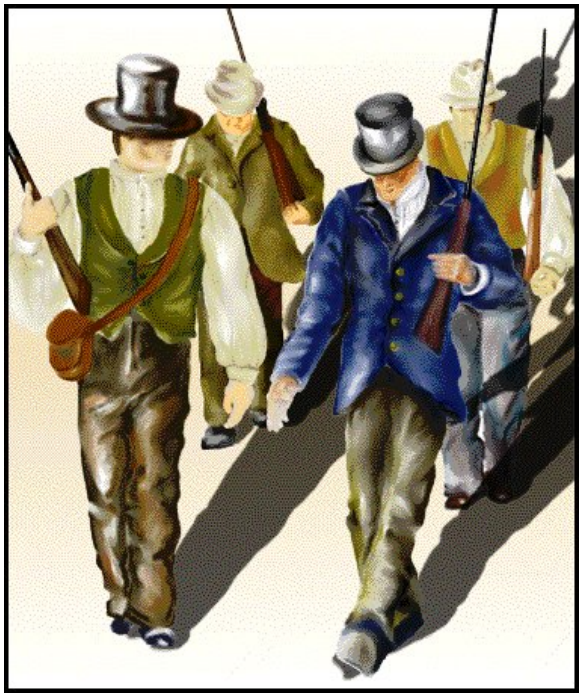
A granite boulder located on the northeast corner of the lodge at Lacey-Keosauqua State Park commemorates the Honey War, an early border dispute between the citizens of Van Buren County and the State of Missouri. The "war" was triggered by an incident that occurred in 1839 in what is now the park.

In 1834, Van Buren County was carved out of the larger Des Moines County, in the southwest corner of Wisconsin Territory. Then, in 1838, the Wisconsin Territory was further divided, with the area west of the Mississippi River designated as Iowa Territory. But, the boundary between Iowa County and Missouri (which had become a state in 1821) was not clearly defined. One incident that occurred in 1839 because of this uncertain boundary became known as the Honey War. The story of the Honey War, when 1,200 Iowans faced off against 2,200 Missouri militiamen, was reported by Andy Reddick (a 5th generation Van Buren County citizen and historian) in his *Country Facts and Folklore* page, a part of the IAGenWeb project:

> "Controversy existed over the location of the Des Moines Rapids. According to the old Sullivan Line of 1816 made by surveyors, the state line was to "angle westward from the Des Moines Rapids," and was to extend from the Mississippi to the Missouri River, except for a

small triangle of land between the Des Moines and Mississippi Rivers known as the "Half-breed Tract" (reserved for those whose blood was from more than one race whether their skin be brown, red, white, or black). Iowans claimed that the line extended from rapids on the Mississippi River near the present town of Montrose, known as the Des Moines Rapids. Missouri challenged this by pointing out ripples in the Des Moines River at Des Moines City, claiming this to be the boundary line. There were also ripples at Bonaparte and some several miles below Farmington that were considered by some to be the location described by surveyors.

The Governor of Missouri asked his agents in Kahoka to collect taxes from residents living north of the disputed border. This included people scattered through southern portions of the counties of Van Buren and what is now Davis. Some of the Iowans refused to pay, chasing away the revenuers with pitchforks and clubs. Before the collectors left the vicinity, however, they chopped down several bee trees in what is now Lacey-Keosauqua State Park and extracted the honey as partial payment for the taxes.



Iowa Territory irregulars mobilize to meet a force of militia from Missouri in the 1839 Honey War boundary dispute. Painting from Weaver, 1999.

When Missouri's governor was informed that these new citizens had refused to pay his taxes, he employed the state militia, sending them northward to the border. Meanwhile, the angered Iowans assembled a posse, captured and kidnapped the sheriff of Clark County, and incarcerated him in a Muscatine jail. Then they paid a visit on Territorial Governor Dodge in Burlington and advised him of the situation. Dodge sent his militia into Van Buren County to "counter" any attack made by Missouri, but also wisely contacted the Missouri governor. While the two militias stood on each side of the border making faces at each other, the two men settled their differences and agreed to allow the U.S. Congress to resolve the dispute.

An arbitrary line was drawn half way between the two disputed lines extending slightly southwestward until it reached the same longitude as the rapids at Montrose (the old Sullivan Line), then extending straight west to the Missouri River. The sheriff of Kahoka was released and allowed to return to Missouri. Tax officials were instructed to refrain from any attempt to collect taxes from their northern neighbors until Missouri could rightfully claim the land, and the governors called back their militiamen."

The Honey War

(Sung to the tune of *Yankee Doodle*)

by John I. Campbell

Ye freeman of the happy land
Which flows with milk and honey,
Arise! To arms! Your ponies mount!
Regard not blood or money.
Old Governor Lucas, tiger-like
Is prowling 'round our borders,
But Governor Boggs is wide awake –
Just listen to his orders.
Three bee-trees stand about the line
Between our State and Lucas.
Be ready all these trees to fall,
And bring things to a focus.
We'll show old Lucas how to brag,
And seize our precious honey!
He also claims, I understand,
Of us three-bits of money!
Conventions, boys, now let us hold
Our honey trade demands it;
Likewise the three-bits, all in gold,
We all must understand it!
Why shed our brother's blood in haste,
Because "big men" require it.
Be not in haste our blood to waste,
No prudent men desire it.
Now, if the Governors want to fight,
Just let them meet in person,
And when noble Boggs old Lucas flogs,
T'will teach the scamp a lesson.
Then let the victor cut the trees,
And have three-bits in money,
And wear a crown from town to town,
Anointed with pure honey.
And then no widows will be made,
No orphans unprotected.
Old Lucas will be nicely flogged,
And from our line ejected.
Our honey trade will then be laid
Upon a solid basis,
And Governor Boggs, where'er he jogs,
Will meet with smiling faces.

This poem was first published in *The Palmyra Whig* on Dec. 26, 1839. It was written by John I. Campbell, a local satirist from Marion County. Campbell became a founding member of the Missouri State Historical Society. Weaver, 1999.

When the Territory of Iowa became a state in 1846, Congress finally moved to determine the permanent boundary between the two states. They decided in favor of the new State of Iowa, making the line that was drawn to end the Honey Wars the official state boundary. To mark the boundary line, wooden stakes were driven every mile across the state with every tenth marker being iron. According to published accounts, a Missourian who cut down several bee trees in the disputed area was sued in an Iowa court, found guilty, and assessed $1.50 in costs and damages. The court decision inspired John I. Campbell to write a poem in 1939 titled "The Honey War." Sung to the tune of Yankee Doodle, it was a favorite in Missouri during the 1840s. Before the Civil War, this boundary marked freedom for blacks, from the slave State of Missouri to the free State of Iowa. The Iowa Territorial Militia, which was organized in 1838 and first mobilized in 1839 to go to war against Missouri in the Honey War, ultimately evolved into the Iowa National Guard.

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MORMON PIONEER MIGRATIONS ACROSS SOUTHEAST IOWA

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BACKGROUND AND EARLY CHURCH HISTORY

Between 1846 and 1857 not fewer than 20,000 members of the Church of Jesus Christ of Latter-Day Saints, popularly known as the Mormons, crossed Iowa by wagon or on foot, the vast majority of them on their way to the valley of the Great Salt Lake in Utah Territory. What follows is a brief history of the their migrations through southeast Iowa and the circumstances leading thereto, with emphasis on the most famous of their treks, which passed through southeast Iowa in early 1846, and which produced the most well known of several Mormon trails.

The settlement of southeast Iowa by European Americans officially began in 1833. The Sac and Fox were forced to surrender their tribal lands in eastern Iowa after their defeat in the infamous Black Hawk War of 1832 (Cole, 1938). By the late 1830s, thriving communities had been established along the Des Moines River in Van Buren County, among them Farmington (1833), Bonaparte (1837) (which boasted 40 to 50 houses and a flour mill), Bentonsport (1836), and Keosauqua (1839).

The Church of Jesus Christ of Latter-Day Saints (hereafter referred to as the Church) had its beginnings in western New York state in 1830, under the leadership of its prophet and president, Joseph Smith. Being located in a region of intense religious revivalism, and having an aggressive missionary system, the Church grew rapidly.

In early 1831 began the first of several migrations of the Church, this time to northern Ohio, just east of Cleveland. They built several communities, the largest at Kirtland. Growing hostility with old settlers, and some disaffected Mormons, along with the financial panic of 1837, combined to cause the Church to move again, this time to western Missouri, where a second gathering of Church members had matched the Ohio growth.

Western Missouri was the frontier, and the Mormons, most of whom were easterners with conservative and anti-slavery views, did not mesh well with the old settlers, many of who were uneducated, religiously intolerant, and pro-slavery. Yet the Church continued to attract converts. The growing size of the Church, and the tendency of its members to band together, socially and politically, caused them to be viewed by their neighbors as a growing threat. Hostilities came to a head in the fall of 1838, when Lilburn Boggs, Governor of Missouri, issued a decree, with military force to back it up, that the Mormons were a menace and "must be exterminated or driven from the state". During the winter of 1838, with Joseph Smith and other Church leaders incarcerated at Liberty, Missouri, about 7000 Mormons crossed the Mississippi River into Illinois and took refuge in Quincy and other nearby communities. Some fugitives took a northeasterly path that led them into Iowa up to near Ottumwa, from which they traveled southeastward to cross the Mississippi near Fort Madison (Hartley, 2000) (Figure 1).

NAUVOO, ILLINOIS

In the spring of 1839, the Mormons purchased and began to settle a swampy lowland tract on a bend in the Mississippi River, across from, and about ten miles south of, Fort Madison. They drained the land through a series of ditches and built a community, which they called Nauvoo. By 1846 it was a city of nearly 12,000 inhabitants (comparable in population to Chicago at that time). During its six-year history, Nauvoo produced a 5,000-man city militia (the Nauvoo Legion), two newspapers, a theater, a university, and a lending library. During the height of its growth, seven brickyards were required to meet the demand for building material. The centerpiece of the city was a temple, constructed with blocks of Keokuk Limestone extracted from a quarry just west of town. The temple was begun in 1841 and completed in the winter of 1845, just prior to the exodus (Figure 2). As a matter of interest, this temple was rebuilt in 2002 on the old site, using the original exterior architectural plans. It was originally

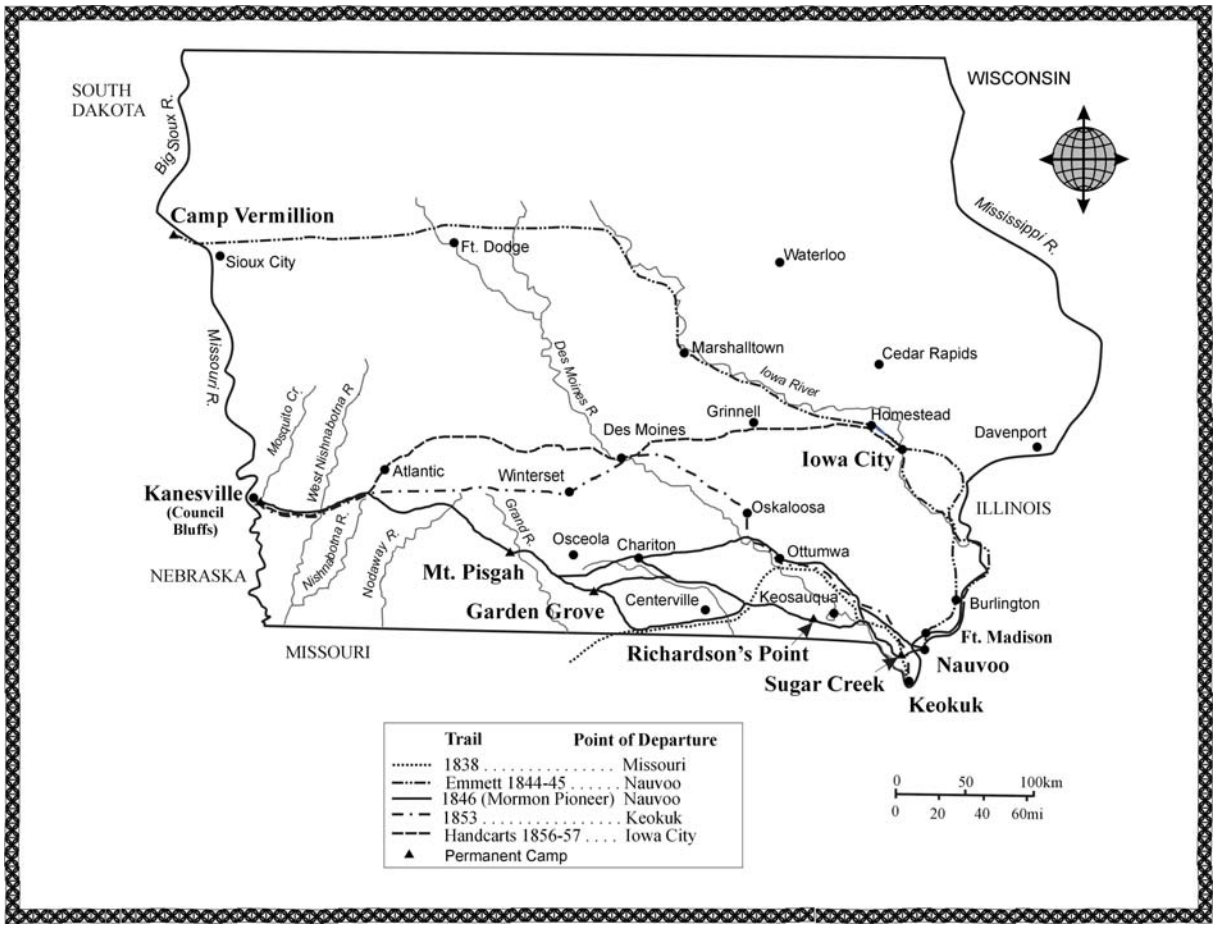

Figure 1. Trails used by Mormons – 1838-1858 (after Klein, *in* Hartley, 2000).

intended that the exterior facing and ornamental stones be obtained from the old quarry. However, as a result of the building of the Keokuk Dam in 1912, the quarry flooded and building stone was unfit for use.

In 1839, the Church purchased about 50,000 acres across the river in Iowa, between Fort Madison and Keokuk, in what was known then as the Half-breed Tract (Hartley, 2000). Here, they established several settlements, including Montrose and Nashville.

The Mormon refugees were initially welcomed by the old citizenry of Hancock County; however, by 1844, because of the large influx of converts (many from England) and growing concerns about the political influence that such a large, tightly knit, group might wield, and being deeply divided by religious and social differences, the old citizens and the Mormons became bitter enemies. The new temple was viewed by some as a symbol of Mormon power and dominance. The culmination was the murder of their prophet leader, Joseph Smith and his brother Hyrum, in a jail at nearby Carthage on June 27, 1844. During the hostilities of 1844, many of the Mormons who had settled across the river in Iowa moved to Nauvoo for safety.

Discovering that the deaths of their leaders did not cause the religion to crumble and the Mormons to disperse, their enemies, with support from the Illinois state government, sought to expel them from the state. Mormons were victims of increasing acts of violence, including arson and assault. Joseph Smith had confided to other leaders that the Church would eventually relocate to the Rocky Mountains. In 1844, two weeks before his death, he commissioned an advance party of 150, under the leadership of James Emmett, to establish a Mormon settlement on the Missouri River. From Nauvoo they traveled northwestward to Iowa City, followed the Iowa River to near present-day Iowa Falls then headed west, crossing the Missouri River near Sioux City. They established a winter camp (Camp Vermillion) near Vermillion, South Dakota (Hartley, 2000) (Figure 1). They would eventually join the Nauvoo exiles at Kanesville.

Under the leadership of Joseph Smith's successor, Brigham Young, the Mormons spent the winter of 1845 building and outfitting some 3000 wagons, making tents, and procuring oxen, mules and horses for the journey. All kinds of wagons were used, but by far the majority were structurally-reinforced farm wagons with covers made of common sheeting, designed to carry a 1,000-pound load. Large Conestoga wagons (of the type seen in Hollywood movies) were rarely used. Departure was planned for the following spring (when grass would be available for the livestock). Their destination was the Great Salt Lake Valley in Utah Territory, where they hoped to be able to live and pursue their religion without interference.

Figure 2. The Nauvoo Temple. 1846 Photograph. Church Archives, The Church of Jesus Christ of Latter-Day Saints, Salt Lake City, UT.

THE EARLY EXODUS OF 1846

In January 1846, the State of Illinois revoked the Nauvoo Legion charter, leaving the Mormons with little protection from their enemies. There were rumors that Illinois troops were preparing to march on Nauvoo for the purpose of arresting Church leaders. Consequently, most of the leaders decided to leave in February. Others, anxious to be part of the advance company, but not really being prepared for the trek, joined them. On the morning of the February 4th, wagons lined up for miles to cross the Mississippi River into Iowa. At the outset the weather was quite mild. People and wagons were ferried across on flatboats, which was perilous because of strong currents and floating ice. However, in the middle of the month a strong cold front passed through which caused the river to freeze over sufficiently, so that for the next week several dozen wagons crossed on ice to Montrose near the site of the original Fort Des Moines (Hartley, 2000). The 1846 Mormon Trail in Iowa began here.

About 2,500 Mormons, or about one-sixth of those living in or near Nauvoo, gathered at the first permanent camp at Sugar Creek in Lee County about nine miles west of Nauvoo (Figure 3). With the departure two to three months earlier than originally planned, many were ill-prepared for the journey, notwithstanding the fact that a detailed list of foodstuffs and other necessary supplies had been distributed to every family by the fall of 1845 (Kimball, 1991). It should be remembered that the vast majority of these emigrants were recent converts who were raised in the eastern United States or England, and who had left comfortable homes in Nauvoo. For some, it was the first time that they had slept on the ground. From the journal of

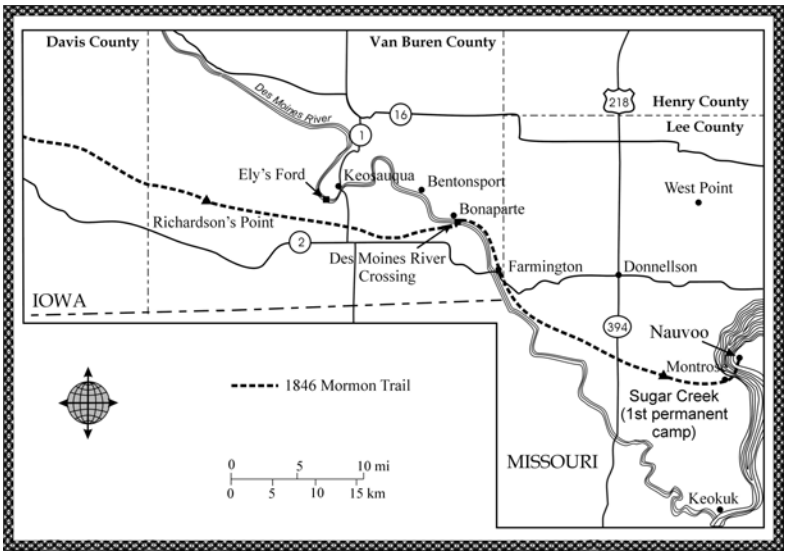

Figure 3. Location of the first 1846 Mormon trail in SE Iowa.

William Pace, February 18, 1846: "Our camp was made in the snow about 8 inches deep and was a rather uncomfortable introduction to camp life without tent or any shelter save it be a wagon cover made from common sheeting. Here we stayed for some time awaiting the arrival of all those who could possibly supply themselves with teams" (Pace, 1846). During late February the temperature plunged to as low as twelve degrees below zero and, understandably, there was considerable suffering. Births and deaths occurred at the camp.

Gathering continued at Sugar Creek until March 1st, when Brigham Young gave the order to move westward. By then it is estimated that the "Camp of Israel" contained about 500 wagons and 2,500 men, women, and children (Kimball, 1991). The southeast Iowa portion of the journey was the most difficult for the advance company, largely because of difficult terrain, primitive roads, and poor weather conditions.

The wagon train traveled along the north side of the Des Moines River through Farmington to Bonaparte, where a shallow, rocky river bottom provided a good ford (Figure 3). Eliza R. Snow, a Mormon poetess, recorded the following in her diary, "Thursday, March 5: Sister Markham and I are nicely seated in an ox wagon on a chest with a brass kettle and the soap box for our footstools, thankful that we are so well off. The day is fine. We traveled two miles on the bank of the river and crossed at a little place called Bonaparte. I slung a tin cup on a string, and drew some water which was a very refreshing draught" (Snow, 1846). The crossing is marked by a sign on the Bonaparte side of the river at the bridge on State Highway 79. The sign reads: "Brigham Young and band of Mormons crossed the Des Moines River here March 5, 1846 on their trek to Utah." The trail passed south of Bentonsport and west toward Keosauqua (Figure 3).

During March, frequent rains and the spring thaw, combined with the hilly nature of the country in Van Buren County, made wagon travel extremely difficult. Heavy wagons had to be unloaded when stuck, pulled to firm ground, and then reloaded. It was often the case that teams of oxen had to be unhitched from one or more wagons and hitched to one that was mired in the mud in order to pull it out. Often they only made two or three miles a day. The wagon train slogged on to a place about ten miles west of Keosauqua called Richardson's Point, where a temporary camp was established (Figure 3). They remained here from March 7th to March 18th, waiting for the weather to improve and the ground to firm up. While here, the Nauvoo Brass Band, under the direction of William Pitt, was invited to perform four concerts for the citizens of Keosauqua, three at the Van Buren County Courthouse (Figure 4), the fourth at the Des Moines Hotel. The courthouse was built in 1843 and is the oldest continuously used courthouse in Iowa. Each engagement required a 20-mile roundtrip by wagon from the camp. For their efforts, they received much-needed cash and supplies for their journey. A monument to the Mormon crossing of the Des Moines River at Ely's Ford stands in Lacey-Keosauqua State Park. However, Mormons from the advance company did not cross here. Some later travelers may have done so.

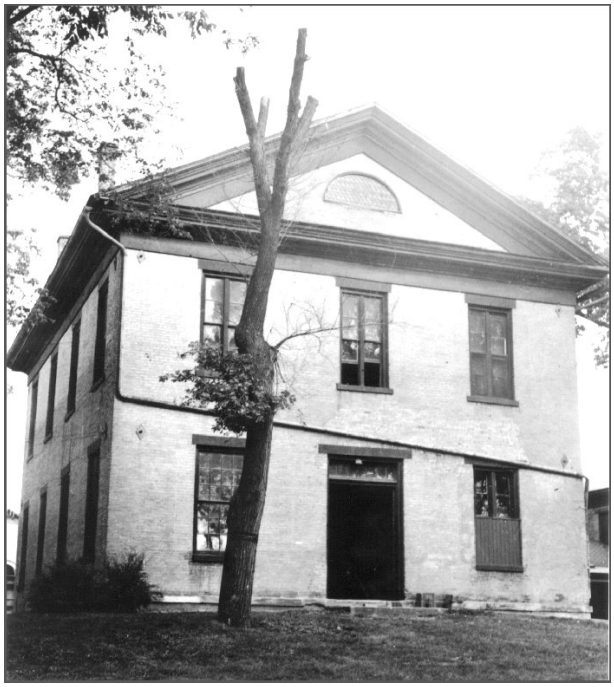

Figure 4. The Van Buren County Courthouse at Keosauqua. Photo taken in 1939. State Historical Society of Iowa, Iowa City, IA.

As the wagon train moved westward, weather and trail conditions gradually improved. Temporary settlements were established at Garden Grove (Decatur County) and Mount Pisgah (near Thayer, Union County). The advance company left some supplies for those who would follow at these and other camps along the way.

The original plan had been to make the entire journey to Great Salt Lake Valley in a single season. However, travel through Iowa had been extremely slow. Though they followed existing, if primitive, roads on the eastern part of the trail, there were only Indian trails in the western part. Fords had to be dug down and bridges built. It took three and a half months for the advance company to cross Iowa. By comparison, spring and summer travelers made it in a month. In addition, many emigrants were inadequately prepared for the 1,300-mile journey. Those who had the recommended two-year of supplies ended up sharing with those who did not, so that their supplies ran out in a few weeks. Brigham Young saw the necessity of halting the wagon train at the Missouri River for the winter. From 1846 to 1852 they established at least 90 temporary settlements in and around Council Bluffs (Hartley, 2000). The largest of these communities was Kanesville, with 3,000 inhabitants at its peak. They also created a settlement across the Missouri River in Indian Territory, which they called Winter Quarters, near present-day Omaha.

The Mormons would embark again the following spring, and travel across Nebraska and Wyoming during the spring and summer of 1847. The vanguard would arrive at Great Salt Lake Valley on July 24, 1847.

LATER 1846 MIGRATIONS

The vast majority of the Mormons left Nauvoo during April, May and June, as planned, five times as many as had left in February (Hartley, 1997). They included some from the advance company who had returned with wagons to pick up family members. They left not as a single large company, but as individual families or small groups when they completed outfitting. These later emigrants found travel conditions much better and the journey much easier. They generally did not follow the trail of the advance company, but took more northerly routes where road conditions were better (Figure 1). Some, not having sufficient feed for their livestock, nor food for themselves for the long trek, and not knowing where the Camp of Israel was going to winter, sought employment in villages along the trail, including Montrose, Farmington, Bonaparte, Bentonsport, Keosauqua, and Iowaville. They chopped wood, split rails, mended fences, husked corn, dug coal, and worked in various types of building construction. Mormon brick and stone masons are credited with building several of the buildings in Bentonsport, among them a brick hotel, the Ashland House, (now known as the Mason House Inn) (Figure 5), and a limestone house, referred to today as the Mormon House (Figure 6). Some families remained in these communities for as much as six years (Hartley, 1997).

Figure 5. The Ashland House (now known as the Mason House Inn) in Bentonsport, Iowa. Photo taken in ca. 1855. *Chuck and Joy Hansen, Bentonsport, Iowa.*

It should be noted that the Mormon trails were not one-way. Members of earlier companies frequently returned east to pick up later-departing family members, and to resupply and, in some cases, rescue companies following behind.

By September, most Mormons had left Nauvoo, except those who were too sick or too poor to outfit themselves. Mobs, literally at gunpoint, forced these unfortunate souls across the river with nothing but the clothes on their backs, where, near Montrose, they huddled in what became known as the Poor Camp. Church leaders sent back three wagon trains loaded with supplies from Kanesville, but many died in the

camp before help arrived (Stegner, 1964). In all, during the three migrations in 1846, about 14,000 Mormons crossed all, or part, of Iowa, most of whom reached the Missouri River by midsummer.

THE 1853 TREK FROM KEOKUK

Figure 6. The Mormon House in Bentonsport. The house was built of local limestone. Photo taken in about 1910. *Chuck and Joy Hansen, Bentonsport, Iowa.*

From 1847 to 1852, European converts traveled up the Mississippi from New Orleans to Saint Louis, and then up the Missouri to Kanesville where they outfitted for the overland trek. But by 1852, almost all Mormons had left Kanesville for Utah. Remaining non-Mormon merchants (who renamed the town Council Bluffs) greatly inflated the prices for outfitting. In addition, steamboat travel up the Missouri was treacherous (Woods and Atterberg, 2002). Consequently, in 1853, the Church designated Keokuk as the outfitting place. That year about 2,500 English, Scottish, Welsh, French, and Dutch emigrants came by river boat up the Mississippi River from New Orleans to Keokuk, where Church agents had set up a large campsite along the bluffs north of town. Getting outfitted took some of the migrants a month. During this time the city hired several men to improve the streets in Keokuk, which were "little more than lanes that rain turned into seas of sticky mud…Main Street was nearly graded, presenting a straight and unbroken avenue of nearly a mile. Mormons, a local history credits, played a key part 'in making the muddy lanes of Keokuk into proper streets'" (Hartley, 2000; Woods and Atterberg, 2002). Others were employed in cleaning houses. Once underway, the wagon train traveled northwestward along the Des Moines River. Reaching Des Moines, they turned west and followed the Des Moines-to-Council Bluffs Road (Figure 1). The trip through Iowa took about four weeks.

THE HANDCART AND WAGON TREKS OF 1856-57

With the coming of the railroad into Iowa in the 1850s, Iowa City became the outfitting place for a few thousand migrants. This time, in addition to teams and wagons, hand-drawn carts were used. This strategy was necessitated by the fact that many European converts could not afford a wagon and a team of animals to pull it. Seven handcart brigades and six wagon trains departed from a camp on the west side of Iowa City during 1856 and 1857. They traveled northwest to Homestead, west to Grinnell, Des Moines, Adel and Dalmanutha, then southwest toward Council Bluffs (Figure 1) (Hartley, 2000). Handcarts were able to move more easily than wagons because they did not have to concern themselves with matters related to feeding, watering, shoeing, and hitching and unhitching livestock. About 2,500- 3,000 Mormons outfitted in Iowa City during these two years. A monument to the handcart pioneers can be seen in the Mormon Handcart Park, just off Mormon Trek Boulevard in Iowa City.

CONCLUSION

The Mormons left a legacy in Iowa. They created well-established trails, which were subsequently used by others heading west. They built communities, such as Garden Grove and Kanesville, which served non-Mormons as well as Mormons. They left their mark as masons and bricklayers, and road, ferry and bridge builders. Diarists in the 1846 exodus, the 1853 wagon trains from Keokuk, and the Iowa City handcart and wagon companies have provided very valuable descriptive information about Iowa in those years, including landscapes, descriptions and locations of rivers and creeks, and the conditions of

climate. Thirteen historic trail sites in Iowa, including the trailhead at Old Fort Des Moines, Sugar Creek, the Des Moines River crossing at Bonaparte, and Richardson's Point have been recommended for inclusion in the National Register of Historic Places. The 1846 trail of Brigham Young's advance company has been designated the Iowa part of the Mormon Pioneer Trail, which extends 1,300 miles from Montrose, Iowa to Salt Lake City, Utah.

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VEGETATION AND FLORA OF LACEY-KEOSAUQUA STATE PARK

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Lacey-Keosauqua State Park is one of the flagship parks in Iowa because of its status as one of the oldest units in the state park system, its large size, and its preponderance of natural forest. Dedicated in 1921 (only one year later than Backbone State Park, widely recognized as the first state park in Iowa), Lacey-Keosauqua State Park is over 1500 acres in size, adjoined on the west by nearly 1000 additional acres in the Keosauqua Unit of Shimek State Forest (Figure 1). Flanking a large bend in the Des Moines River, this 2500-acre complex of public land contains a rugged, primarily forested landscape of highly dissected hills with narrow ridges, narrow valleys, and steep slopes.

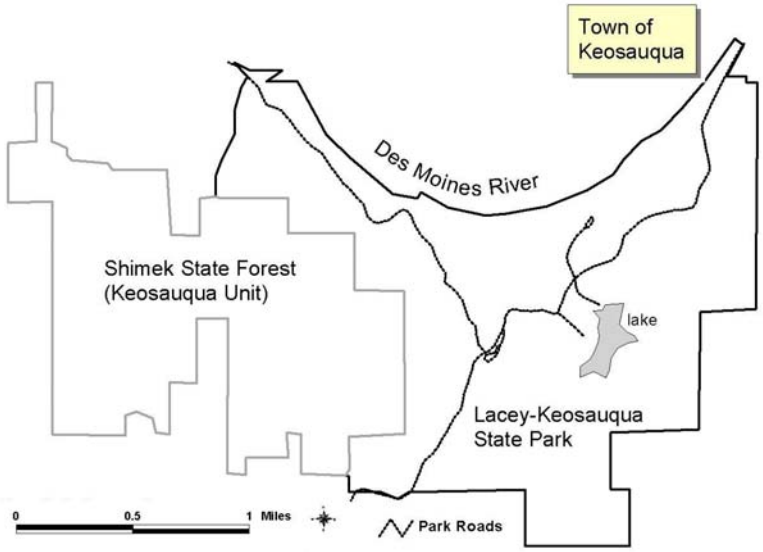

Figure 1. Outline map for Lacey-Keosauqua State Park and Keosauqua Unit of Shimek State Forest.

Vegetation

The vegetation in Van Buren County encountered by General Land Office (GLO) surveyors in 1837 was generally a mosaic of prairie on broad, interfluvial uplands and forest ("timber" in the original vernacular) in the valley of the Des Moines River and its major tributaries (Figure 2). In the two townships immediately surrounding what is now Lacey-Keosauqua State Park, the forest portion of the mosaic was described by the surveyors as a complex of "timber", "scattering trees", and "openings", indicating that the forest was not a uniform expanse of unbroken tree cover, but rather an interspersion of forested and non-forested units at a scale that was too fine to depict on a township plat (36 square miles). Many small, cultivated fields were present in 1837 (black polygons in Figure 2), challenging the efficacy of the term "pre-settlement vegetation" often applied to these maps. Other features of interest on the historic GLO map are two areas of "windthrow" marking the path of tornadoes north and east of the park (cross-hatched polygons in Figure 2). Lacey-Keosauqua State Park occurs entirely within the complex of timber, scattered trees, and prairie openings mapped by the GLO surveyors for the entire township. In 1837, prairie was mapped only along the western edge of the Keosauqua Unit of Shimek State Forest. No cultivated fields were mapped within the future park or forest areas at that time.

The next available glimpse of vegetation in Lacey-Keosauqua State Park and the Keosauqua Unit of Shimek State Forest is from aerial photographs taken in 1936 (Figure 3), nearly a century after the GLO maps were drawn and 15 years after dedication of the Park. Forest is still the predominant vegetation in this photograph, but large fields are also evident on broad, gently rolling uplands along the east, south, and northwest borders of the state park and in the western half of the state forest. Long, narrow openings are also evident along the road that traverses narrow, winding ridges in the interior of the park. When contrasted with the current vegetation visible in a 2002 aerial photograph, it is obvious that the large openings have disappeared and become forested (Figure 4).

The timings of land acquisition of specific parcels, cessation of activities that created and maintained the openings, and invasion of trees into the idled fields provide interesting insights into the process of natural succession. There were two main acquisitions of land for the park, the first (comprising most of the park) in 1920 and the second (a parcel located east of the lake and south of the park road along the east border) in 1936. Other parcels were acquired in later years, but are smaller and will not be seen during the field trip. Except for one large field (in the northwest corner of the park) used as a golf course until around 1970, the 1920 acquisition was primarily of forest that had likely been extensively harvested during the first wave of settlement during 1837-1850 and has since redeveloped into mature forest. In contrast, much of the 1936 acquisition was an open field when first added to the park (Figure 3). Thus, the park today contains three age classes of forest: 1) mature forest over 150 years old on rugged topography, speculatively last cut around 1850, 2) mid-successional forest nearly 70 years old, resulting from tree invasion into gently rolling upland fields released from mowing, grazing, and cropping circa 1936, and 3) early-successional forest approximately 30 years old on the gently rolling upland in the former golf course.

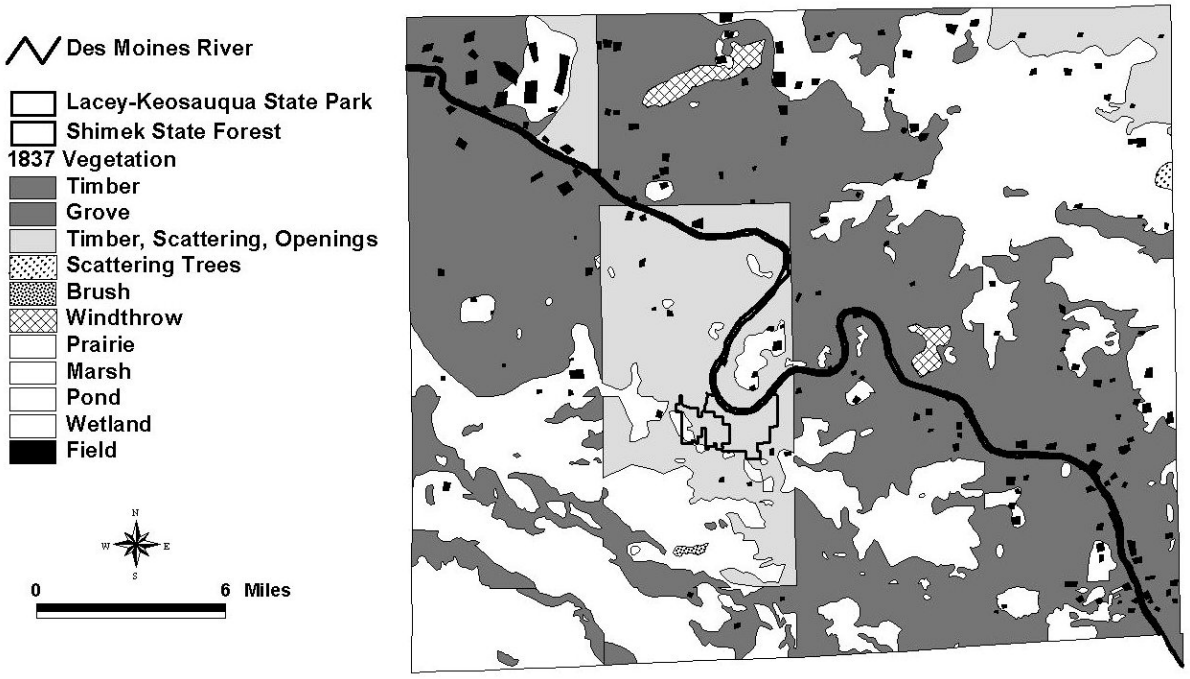

Figure 2. Vegetation in Van Buren County in 1837.

In the mature forest in the park, the dominant trees species are white oak (*Quercus alba*), red oak (*Q. borealis*), sugar maple (*Acer saccharum*), and basswood (*Tilia americana*). Large-diameter oaks typically form a tall canopy in these woods. Along the bluffs along the Des Moines River in the northwest part of the park, the mature forest community includes several individuals of white oak that are 200-300 years old. Ironwood (*Ostrya virginiana*) and buckeye (*Aesculus glabra*) are the common understory trees in the woody vegetation layer between the forest canopy and the forest floor. Shrubs are generally sparse, but include species such as fragrant sumac (*Rhus aromatica*) and gooseberry (*Ribes missouriense*). Common herbaceous plants on the forest floor here include Pennsylvania sedge (*Carex pensylvanica*), bottlebrush grass (*Hystrix patula*), slender wildrye (*Elymus villosus*), shining bedstraw (*Galium concinnum*), pointed-leaf tick-trefoil (*Desmodium glutinosum*), woodland phlox (*Phlox divaricata*), and wild ginger (*Asarum canadens*e).

The mid-successional forest that developed on old fields idled after acquisition for the park in 1936 is characterized by a diverse mixture of tree species in the canopy, including honeylocust (*Gleditsia triacanthos*), black locust (*Robinia psuedoacacia*), ash (*Fraxinus spp*.), elm (*Ulmus spp*.), walnut

(*Juglans nigra*), black cherry (*Prunus serotina*), and hackberry (*Celtis occidentalis*). The primary oak species present here is shingle oak (*Quercus imbricaria*), a pioneering species in old fields in southern Iowa. White oak and red oak are present as scattered individuals and in small groves, but otherwise form a relatively minor part of the canopy, especially in the center of the old field farther from the original forest edge. Eastern red cedar is common, but mostly as dying trees overtopped by taller, deciduous trees. Shrubs form an obvious layer in this forest compared to the mature woods, including exotic species such as autumn-olive, multiflora rose (*Rosa multiflora*), Japanese barberry (*Berberis thunbergii*), and Amur honeysuckle (*Lonicera maackii*) and native species such as fragrant sumac, redbud (*Cercis canadensis*), and coral-berry (*Symphoriocarpos orbiculatus*). Herb species include species of the mature forest mixed with others that typically increase on disturbed areas: white snakeroot (*Eupatorium rugosum*), ebony spleenwort (*Asplenium platyneuron*), nimblewill (*Muhlenbergia schreberi*), clearweed (*Pilea pumila*), and stinging nettles (*Urtica dioica*).

The early successional forest occupying the old golf course in the park is interspersed with grassy openings, thickets, and patches of taller trees. The most frequently observed trees are boxelder (*Acer negundo*), honeylocust, northern pin oak (*Quercus ellipsoidalis*), shingle oak, walnut, black cherry, ash, and Amur maple (*Acer ginnala*), an escape from cultivation once planted along the fairways of the golf course. The most common shrubs are gray dogwood (*Cornus foemina*), multiflora rose, autumn-olive, fragrant sumac, and blackberry (*Rubus allegheniensis*). Herbaceous species comprising a significant cover in the grassy openings include non-native fescues (*Festuca pratensis* and *F. arundinacea*), introduced turf grasses), tall goldenrod (*Solidago altissimum*), thoroughwort (*Eupatorium altissimum*), and cudweed (*Gnaphalium obtusifolium*), as well as patches of the native grasses big bluestem (*Andropogon gerardii*) and Indiangrass (*Sorghastrum nutans*).

Comparison of the tree species composition of the three age classes in the park shows a relative lack of white oak and red oak in the younger, successional stands. These two species are the typical dominants in the old forest, but are present only as widely scattered individuals in the early successional forest and as scattered individuals and patches in the mid-successional forest. Evidently, the conditions needed for regeneration and early growth of white and red oak were not present over much of the old fields when they were idled, due possibly to compacted soil and competition from grasses in the original clearings (golf course, pastures, and cropfields), and later from competition with other tree species that had invaded the site. Barring management intervention to create openings, future conditions for regeneration of these shade-intolerant oaks can only be expected to decrease with increasing shade in the successional forests. Despite the reclamation of old fields by trees and the physiognomic resemblance of the successional woods to the older woods, the old stands that were not subjected to clearing, grazing, and mowing prior to establishment of the park remain the best examples of a forest with the species composition expected in a natural woodland.

Flora

Lacey-Keosauqua State Park has attracted several well-known botanists over the years. Among the species collected in the park by venerable Iowa botanist and geologist Bohumil Shimek was the brown twayblade orchid (*Liparis liliifolia*), in 1930. Jesse Fults documented golden corydalis (*Corydalis aurea*, now classified as threatened under state law) in 1933. The most comprehensive list of plants for the park, containing nearly 400 vascular species, was compiled in 1936 by Charles Gilly and Malcolm McDonald. Interestingly, their nearly 70-year old list (typed on onion skin paper and discovered in DNR files while preparing this article) includes Prairie Bush Clover (*Lespedeza leptostachya*), now officially classified as a threatened species under state and federal law and with seemingly no suitable habitat in the park today. (However, without a voucher specimen, it is impossible to confirm this identification. As this article was being completed, botanist Bill Watson of Cedar Falls searched the historical Parsons College collection- now residing at the University of Northern Iowa- where Gilly and McDonald deposited their specimens, but could find no specimen of this species attributed to Lacey-Keosauqua State Park.) In 1959, Robert Davidson completed a plant survey of a broad, 13 - county region in southeast Iowa. Among his many

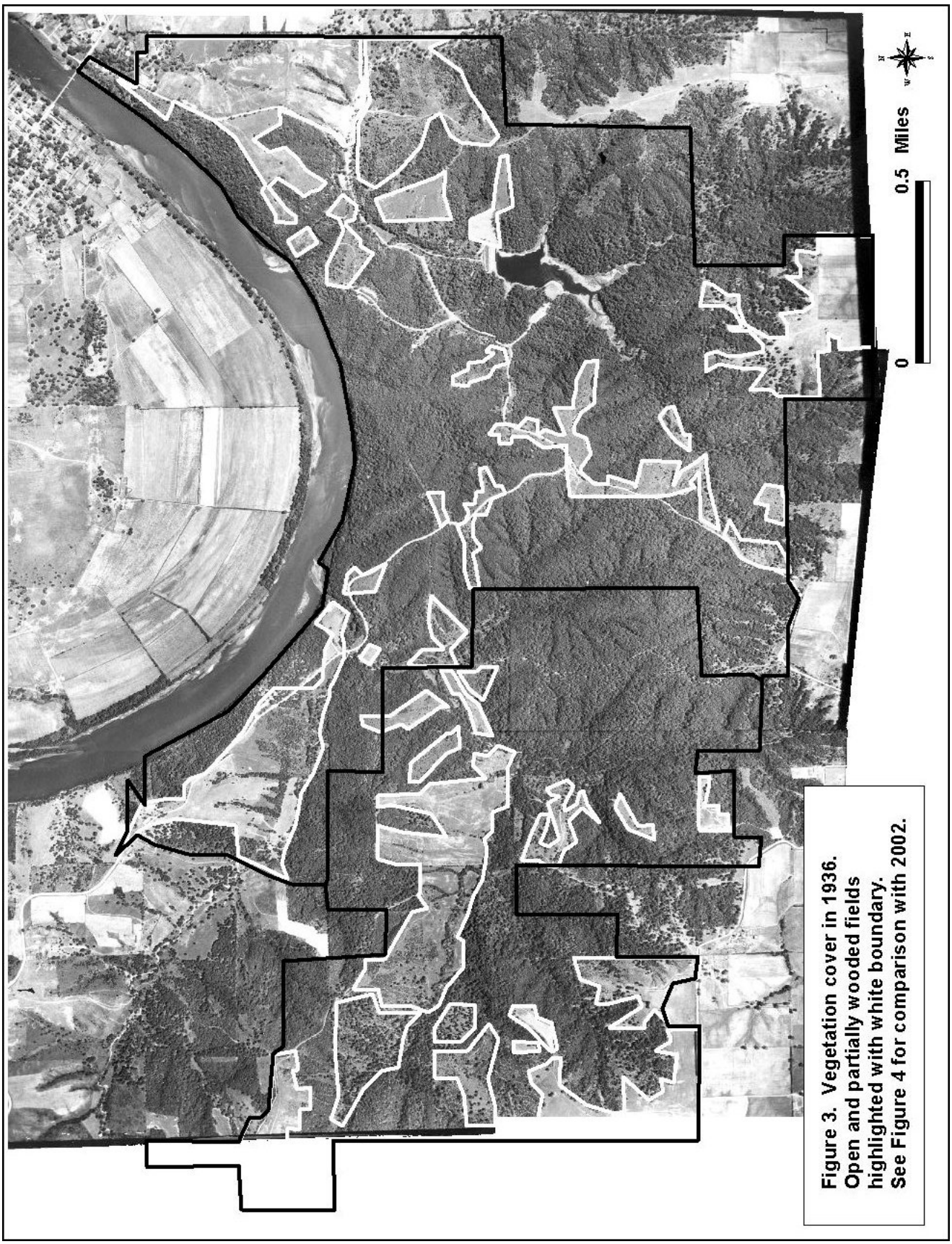

Figure 3. Vegetation cover in 1936. Open and partially wooded fields highlighted with white boundary. See Figure 4 for comparison with 2002.

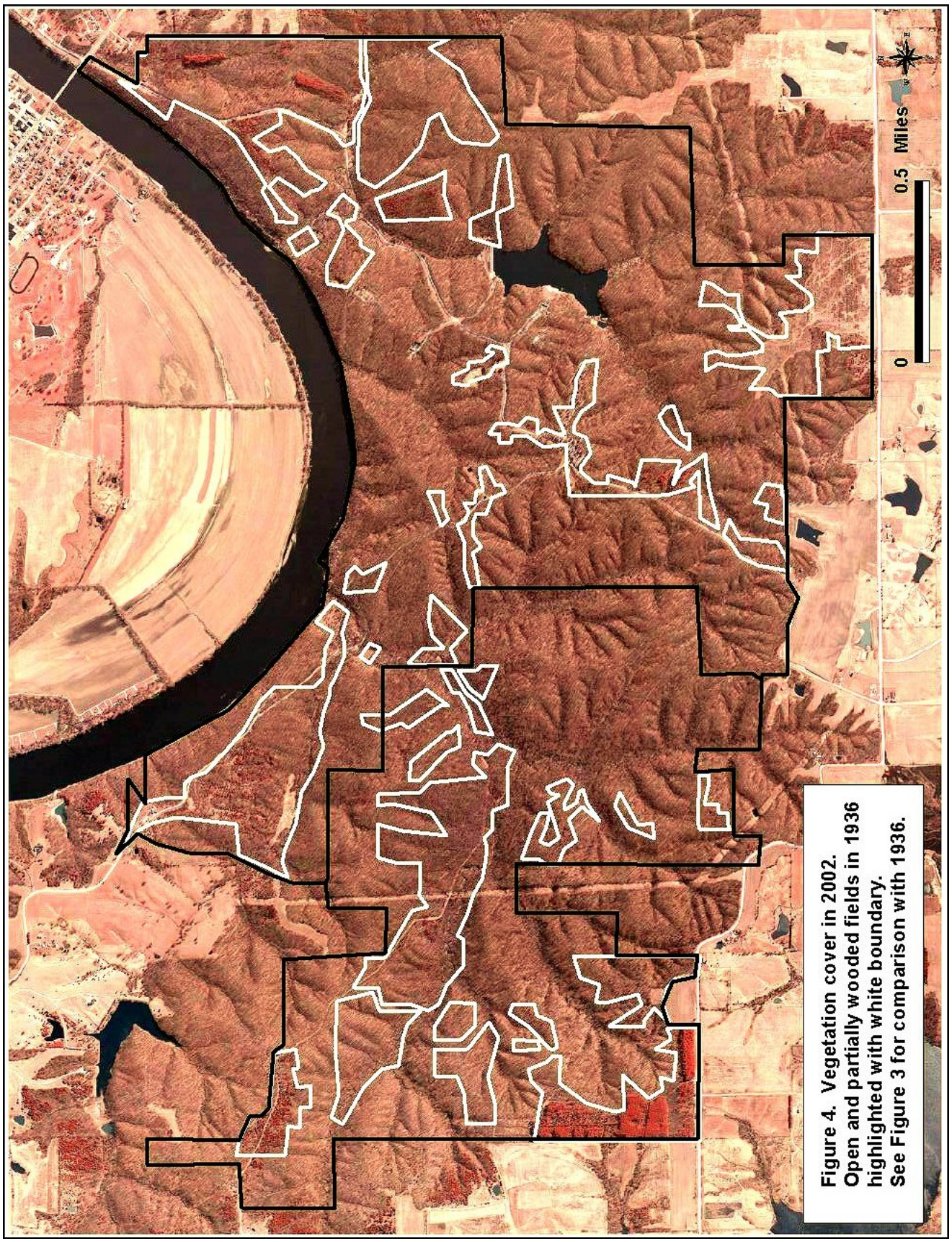

Figure 4. Vegetation cover in 2002. Open and partially wooded fields in 1936 highlighted with white boundary. See Figure 3 for comparison with 1936.

collecting stations were Lacey-Keosauqua State Park and the Keosauqua Unit of Shimek State Forest, where he documented false hellebore (*Veratrum woodii*, threatened), pagoda plant (*Blephilia ciliata*, threatened), and prairie-tea (*Croton monanthogynus*, special concern). In 2001, DNR botanist Mark Leoschke discovered the slender ladies'-tresses orchid (*Spiranthes lacera*, threatened) in the state forest. A modern, comprehensive update of the flora of the park and associated public lands would be very informative and useful.

WILDLIFE OF THE LACEY-KEOSAUQUA STATE PARK AREA

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Lacey-Keosauqua State Park, the Keosauqua Unit of Shimek State Forest, and Lake Sugema Wildlife Area provide a diversity of habitats for wildlife species. The state park and forest unit is characterized by steep rolling oak-hickory forest along the Des Moines River. The wildlife area provides grassland, restored prairie, and agricultural fields around a 575-acre reservoir.

WILDLIFE SPECIES

Birds

The park and forest unit are excellent areas to observe forest birds, such as worm-eating warbler, Kentucky warbler, ovenbird, scarlet tanager, and pileated woodpecker. The large sycamore trees along the creek near Ely Ford provide habitat for northern parula, yellow-throated, and cerulean warblers. Louisiana waterthrushes can be found along this creek. Sandrock (1986) reported 166 species in the park and vicinity during five years of extensive birding in the early 1980's. Eighty-three species of birds were reported in the park and adjacent area during the Breeding Bird Atlas Project (Table 1). Birders can find all of the vireos and many of the thrushes, woodpeckers, and flycatchers in the park during the breeding season. The downy woodpecker, northern flicker, black-capped chickadee, white breasted nuthatch, house wren, northern cardinal, American robin, chipping sparrow, American goldfinch, and Baltimore oriole are common in the park and surrounding area. Wild turkey (Figure 1) can be observed year-round in the park and the adjacent forest unit. A pair of bald eagles was reported using a nest across the river from the park in 2003.

The loud notes of the whip-poor-will can be heard in the park on calm nights in late spring and early summer. If the bird is close, your sleep may be disrupted until the bird moves to another portion of its territory. Although rarely seen, it is a common species in heavily wooded areas of the state. The whip-poor-will is active at dusk and during the night, pursuing flying insects on the wing. The wide mouth allows the bird to capture large flying insects, such as cutworm moths, other large moths, June bugs, and night flying insects. The mottled brown gray and black coloration of the whip-poor-will provides excellent camouflage for nesting birds or those sitting lengthwise on a horizontal branch. The nest is a simple depression on the leaves of the forest floor. Two eggs are the normal clutch size. Incubation takes from 17-20 days and the young fledge after about 3 weeks.

Probably the most easily recognized bird in the park is the male northern cardinal. The bright splash of red as it moves about the trees and shrubs draws your attention to this species. The cardinal was not always a common species in Iowa. In the 1880's, it was considered to be uncommon and found only in the southern part of the state. Since that time it has expanded its range to include the entire state, probably following the wooded river valleys.

During migration, ducks, geese, cormorants, and herons can be seen at Lake Sugema. Canada geese, mallards and wood ducks nest on the area and broods

Figure 1. Wild turkeys are abundant in the area of Lacey-Keosauqua State Park.

Photo by Lowell Wasburn

can be observed in the summer. Northern bobwhite, grasshopper and Henslow's sparrows, and bobolinks nest in the grasslands and weedy fields around Lake Sugema. For many years, this has been the place Iowa birders go to see Henslow's sparrow. Dickcissel, field sparrow, eastern meadowlark, eastern kingbird, brown thrasher, and catbird are all species commonly seen in the grasslands and wooded draws around Lake Sugema.

Mammals

Lacey-Keosauqua, like many state parks, is an excellent place to view white-tailed deer (Figure 2). Raccoons, gray squirrels, and chipmunks are also abundant and can be seen by the observant park visitor. At least 30 of Iowa's native mammal species are known from the park and surrounding area (Table 1) and it is probable that another 10 or 15 will be found with additional surveys.

Figure 2. Many white-tailed deer make the park and surrounding area their home.

Photo by Clay Smith.

Eight of the nine species of bats that regularly occur in Iowa have been found in the park. Only the little brown bat was not captured during a survey in the 1980's. The survey was conducted in summer using mist nets set over streams and across walking trails to determine if the Indiana bat, a federal and state endangered species, was present. All nine species feed on insects and can be found roosting or foraging in woodland or forests. They capture prey and navigate using a highly sophisticated echolocation system. Bats emit pulses of high frequency sound and listen for the echoes reflected back to them. From these echoes, they are able to discern prey items and objects in their path. The sensitivity of their echolocation systems is such that some species are able to detect objects as fine as a human hair.

Figure 3. The red bat is the most common bat in the area of Lacey-Keosauqua State Park.

Photo by Merlin D. Tuttle, Bat Conservation International.

The Indiana bat is a small bat weighing about ¼ ounce. It is 3.5 inches long and has a wingspan from 9 to 10 inches. The Indiana bat hibernates in caves and mines from October to April in states south and east of Iowa. They arrive in Iowa in late April and early May with the females forming nursery colonies under the loose bark of dead or dying trees, usually near a stream or river. A single young is born in June.

Red bats (Figure 3) were the most commonly captured bats during the survey. This species is one of our most attractive bats, with red-orange fur. The tips of the fur are often frosted. It is slightly larger than the Indiana bat and has a wingspan of 11 to 13 inches. The red bat roosts in dense clusters of leaves in woods, along streams, and in urban areas. They are solitary roosters and when hanging by one foot in a clump of leaves in a tree, they appear to be a dead leaf. They emerge early in the evening and forage regularly over the same area including under streetlights. Food items include flies, beetles, cicadas, and moths.

The big brown bat was the second most common bat found during the mist net survey. Big browns are a uniform brown color and have a wingspan of 13 to 16 inches. Summer roosts include natural and human-made structures. Maternity roosts have been found in the attics of houses, barns, bridges, culverts, tree cavities, and under loose bark on large trees. They feed primarily on beetles and moths, includ-

ing some that are agricultural pests. Most big brown bats hibernate in caves and mines in eastern Iowa, but a few hibernate in buildings. Big browns are active in early spring and in late fall and may even emerge during warm nights in winter.

Table 1. List of Animals Observed or Potentially Occurring in Lacey-Keosauqua State Park and Vicinity.

Breeding Birds	Wood Thrush	Little Brown Bat
Turkey Vulture	American Robin	Indiana Bat
Coopers' Hawk	Gray Catbird	Northern Myotis
Red-tailed Hawk	Brown Thrasher	Silver-haired Bat
Ring-necked Pheasant	Cedar Waxwing	Eastern Pipistrelle
Wild Turkey	European Starling	Big Brown Bat
Northern Bobwhite	White-eyed Vireo	Red Bat
Spotted Sandpiper	Yellow-throated Vireo	Hoary Bat
American Woodcock	Red-eyed Vireo	Evening Bat
Rock Dove	Blue-winged Warbler	Eastern Cottontail
Mourning Dove	Northern Parula	Eastern Chipmunk
Black-billed Cuckoo	Yellow-throated Warbler	Woodchuck
Yellow-billed Cuckoo	Cerulean Warbler	Gray Squirrel
Eastern Screech Owl	American Redstart	Western Harvest Mouse
Barred Owl	Worm-eating Warbler	White-footed Mouse
Whip-poor-will	Ovenbird	Deer Mouse
Chimney Swift	Louisiana Waterthrush	Meadow Vole
Ruby-throated Hummingbird	Kentucky Warbler	Woodland Vole
Belted Kingfisher	Common Yellowthroat	Coyote
Red-headed Woodpecker	Hooded Warbler	Red Fox
Red-bellied Woodpecker	Yellow-breasted Chat	Raccoon
Downy Woodpecker	Summer Tanager	Long-tailed Weasel
Hairy Woodpecker	Northern Cardinal	Striped Skunk
Northern Flicker	Rose Breasted Grosbeak	Bobcat
Pileated Woodpecker	Indigo Bunting	White-tailed Deer
Eastern Wood-pewee	Dickcissel	**Reptiles**
Acadian Flycatcher	Eastern Towhee	Northern Watersnake
Eastern Phoebe	Chipping Sparrow	Brown Snake
Great-crested Flycatcher	Field Sparrow	Prairie Ringneck Snake
Eastern Kingbird	Grasshopper Sparrow	Black Rat Snake
Horned Lark	Henslow's Sparrow	Eastern Garter Snake
Purple Martin	Song Sparrow	Slender Glass Lizard
N. Rough-winged Swallow	Red-winged Blackbird	Painted Turtle
Bank Swallow	Eastern Meadowlark	Snapping Turtle
Cliff Swallow	Common Grackle	Smooth Softshell Turtle
Barn Swallow	Brown-headed Cowbird	Spiny Softshell Turtle
Blue Jay	Baltimore Oriole	Slender Glass Lizard
American Crow	American Goldfinch	**Amphibians**
Black-capped Chickadee	House Sparrow	Northern Leopard Frog
Tufted Titmouse	**Mammals**	Green Frog
White-breasted Nuthatch	Virginia Opossum	Bullfrog
Carolina Wren	Least Shrew	Gray Treefrog
House Wren	Short-tailed Shrew	Cope's Gray Treefrog
Blue-gray Gnatcatcher	Masked Shrew	Western Chorus Frog
Eastern Bluebird	Eastern Mole	Cricket Frog

One of the more common small mammals of the park area is the short-tailed shrew. It about the size of a house mouse but has a tail less than one inch long, is dark gray on the back, and lighter gray on the underside and has a long pointed snout. It is a species that domestic cats often catch and leave on the doorstep. The short-tailed shrew is our only mammal that has a poisonous bite. The poison is produced in some of the salivary glands and is delivered when the shrew bites its prey. The poison is used for prey such as mice and slows the victim's heart and respiration rate.

Amphibians and Reptiles

Although there has not been a comprehensive inventory of the amphibians and reptiles of Lacey-Keosauqua State Park and adjacent areas, a list is provided in Table 1 based on records from nearby areas of similar habitats. The slender glass lizard (Figure 4) is the only state listed species known to occur in the area. They are often confused with snakes because they do not have legs like all other Iowa lizards. Glass lizards are light brown with a dark stripe down the back and several along the sides and may be up to 42 inches long. The long tail is very fragile and like the tails of skinks and other lizards, may break if grasped. This is an adaptation to reduce predation. A predator that grasps the tail of the glass lizard is left with a twitching tail while the animal makes its escape.

Figure 4. The slender glass lizard has been reported in Lacey-Keosauqua State Park.

Photo by Jeff LeClere

HABITAT MANAGEMENT

Forest management for mammals and birds has included maintaining mature forest to provide den, roost, and nesting trees. Dead and dying large trees are removed when they pose a potential hazard to the park visitors but are left when possible to benefit mammals and birds. Some tree harvest is necessary to regenerate oaks and other trees that do not tolerate deep shade as seedlings. Harvest at this time is done primarily on the state forest and consists of removing a few trees to make small openings in the canopy to allow sunlight to strike the forest floor.

Management of the Lake Sugema area includes maintenance of grassland habitat for the benefit of species like Henslow's sparrow and dickcissel. Edges, where grassland and woodland meet, also receive attention because species like the northern bobwhite are dependent on these areas. The decline of northern bobwhite populations in southern Iowa during the last 30 years is due to land changes in agriculture. The size of farms and fields has steadily increased, thus greatly reducing the amount of edge habitat. Also the change from mechanical weed control to the extensive use of herbicides has reduced annual weeds, which provide an excellent food source for northern bobwhite and other bird species.

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THE ARCHAEOLOGY OF LACEY-KEOSAUQUA STATE PARK

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> *"The history of Van Buren County is so much older than the period embraced even by Indian legends, that we stand in grave silence before the evidences of those who have gone before…. As these things may be, let us, while now we can, pay to those who have preceded us the passing tribute of a sigh"* (Western Historical Company 1878:335).

The Geological Society of Iowa's 2004 field trip to Lacey-Keosauqua State Park will provide an opportunity to view the park's burial mounds, and to discuss what little we know about the prehistoric Native American use of the area. The following report briefly describes what we know about the archaeology of the park, and discusses the history of archaeological investigation in the park. The final section considers how the knowledge and appreciation of burial mounds in Iowa has changed through time, and how present efforts to identify and preserve mounds benefit from knowledge initially obtained in the geosciences.

ARCHAEOLOGICAL SITES

Fifteen archaeological sites are recorded with the University of Iowa's Office of the State Archaeologist within Lacey-Keosauqua State Park. These include a shell midden, seven habitation or resource-processing sites, and five burial mound sites (Figure 1). Two sites comprise prehistoric artifacts found in alluvial sediments that have probably been subject to fluvial reworking during the historic period. The 15 sites provide tangible evidence that prehistoric Native Americans hunted, gathered, and lived in these bluffs overlooking the Des Moines River and that, for at least part of prehistory between 2,500 and 1,000 years ago, buried their dead in monumental earthworks.

All 15 sites are within 1,000 m of the bluffline, and all but one are within 275 m. Throughout southeast Iowa, both the number of sites and the density of artifacts within sites tend to decrease with distance from major stream valleys (Artz, 1997; Hirst, 1985). In the case of Lacey-Keosauqua, however, it must be noted that only 25 of the park's 1,515 acres have been systematically surveyed for archaeological sites. The known sites are most likely a record of where archaeologists have looked, rather than where sites are actually located.

The density of known sites in the park is about 1 site per 100 ac (i.e., 15 sites / 1,515 ac x 100), but intensive archaeological surveys along the bluffs of the lower Des Moines typically encounter much higher site densities. For example, Hirst (1985) found 18 sites on 698 ac near Bonaparte, a density of 2.6 sites per 100 ac. At Cedar Bluff State Preserve in Mahaska County, Peterson and Wendt (1999) found 23 sites on 236 acres, a density of 10.2 sites per 100 acres. Extrapolating these densities to Lacey-Keosauqua's 1,515 ac, the park might actually contain between 40 and 155 sites.

A DAY IN THE LIFE...: PREHISTORIC OCCUPATION AT 13VB640

Partial excavation of one of the habitation sites, known by its official site number, 13VB640, revealed chert flakes from stone tool making, fire-cracked rocks from hearths and roasting pits, and large stones used as hammerstones, choppers, and grinding stones. A spherical stone with a pitted groove around its circumference was interpreted as a net sinker (Neverett and Huerter, 1993). These artifacts tell us that during their occupation of the site, people cooked food and did a variety of resource processing tasks using temporary tools fashioned from locally available

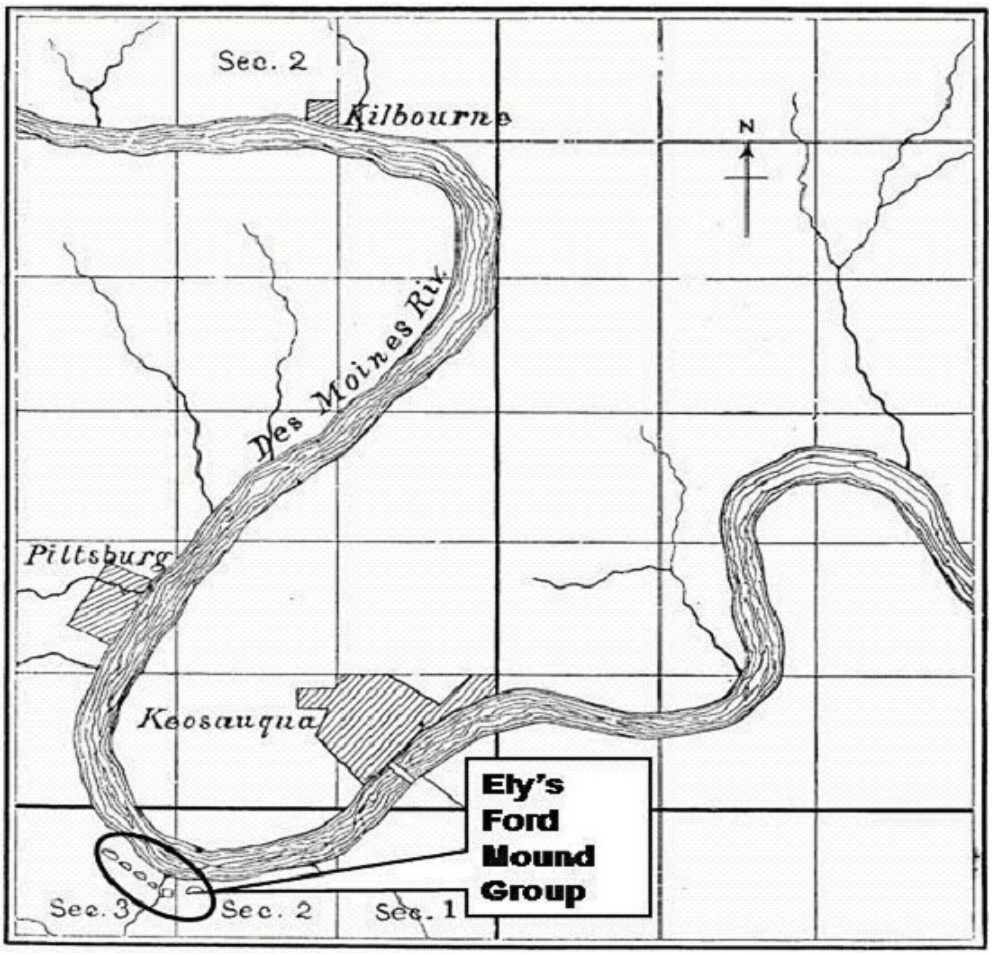

Figure 1. Location of mounds southwest of Keosauqua (from Star, 1895, p. 121).

stones. Chert flaking debris provides evidence for the manufacture and repair of other kinds of tools such as projectile points, bifacial knives, and end scrapers. These kinds of finished, stylistically-patterned tools required considerable time to fashion, and were generally made from high quality raw materials. Because of the investment in their manufacture, they were carefully tended to avoid loss or breakage.

In the case of 13VB640, the fact that no such tools were found is fairly good evidence that the site was occupied by hunting/gathering parties making temporary forays into the area; whose major villages or base camps were located elsewhere in the region. People arrived at the site with complete tool kits, which they carefully tended to avoid breakage, and took with them when they moved on. In addition, artifact density in excavations was relatively low, suggesting that site occupations were brief. In other words, the site was not visited often enough and the stays were not long enough for large amounts of cultural material to build up.

No radiocarbon dates or diagnostic artifacts were found at 13VB640 to indicate its age. The only time-diagnostic artifact I'm aware of from the park is a Late Woodland (ca. 1,000-1,500 years before present) pottery sherd from the shell midden site, 13VB6. The shell midden, perhaps the park's most significant non-mound site, has never been excavated, and its spatial extent and stratigraphic integrity are very poorly known.

HISTORY OF INVESTIGATIONS AT LACEY-KEOSAUQUA

Knowledge of the park's archaeological record has accumulated piecemeal over the last 135 years. The shell midden was discovered in 1869 when workers encountered a thick layer of mussel shells, buried in river alluvium, while digging a hole for a large post to anchor the ferry boat's guide rope. In addition to hundreds of shells, deer and snapping turtle bones, flint flakes, arrowheads, and potsherds were found (White, 1870). The mounds on either side of Ely's Creek were first reported in the late 1870s by Samuel B. Evans of the Ottumwa Democrat. Evans, with the help of local citizens including a Judge Robert Sloan, dug into the mounds in July 1878. In a letter to the Chicago Tribune, Evans described finding fresh-water mussel shells, animal bones, pottery sherds, and arrow heads, as well as human remains from at least four individuals, in the mounds.

The mounds and shell midden were described in the 1879 history of Van Buren County (Western Historical Company, 1879:335, 337-339), and were also mentioned in the first comprehensive summary of Iowa archaeology, published by the Davenport Academy of Sciences (Starr, 1895:120-121). In 1920, when Charles Keyes of Cornell College began the first systematic survey of Iowa archaeology, he relied on publications by Starr (1895) and others, and also corresponded and visited with amateur archaeologists throughout the state. The mounds and shell midden at Ely's Ford were among the sites documented by Keyes (Schermer, 1986).

In the early 1970s, Dean Straffin, an archaeologist at Parsons College in Fairfield, Iowa, began a series of archaeological surveys in southeastern Iowa, much of it focusing on the lower Des Moines River. One of his students, Anton Till, continued this work into the early 1980s (e.g., Till and Nansel, 1981). Till visited the mounds at Ely's Ford and recorded a number of archaeological sites, including previously unrecorded mounds, on the bluffs overlooking the river within Lacey-Keosauqua Park (unpublished site forms on file at the Office of the State Archaeologist).

Additional archaeological surveys were conducted in the park in the 1980s and 1990s. These relatively small scale studies were funded by federal and state agencies prior to campground improvements in the central part of the park, and bridge improvements and the building of an observation tower in the western part (Neverett and Huerter, 1993; Rogers, 1992; Snow, 1995; Till, 1980). The surveys resulted in the recording of two prehistoric campsites.

THE ROLE OF GEOSCIENCES IN PRESERVING PREHISTORIC MOUNDS

The fact that we visited the Ely's Ford mound group on this trip is an indication of the fascination and meaning the mounds hold for us. Unlike prehistoric campsites, evidence of which is usually hiding from us on or beneath the surface of fields and forests, the mounds stand up as a testament to ancient labor and beliefs, inspiring feelings that range from curiosity to reverence. The mounds at Lacey-Keosauqua (Figure 2) still bear the scars of the early interest of Euroamericans, in the form of partially-filled potholes on their tops. Fortunately, Evans, Sloan, and their friends lacked either the interest or energy to do more than open pits down into the mounds. Equally fortunately, the mounds passed into public ownership early in the 20th century, and have been preserved for future generations.

Native Americans have always understood that mounds contain the graves of their ancestors, to be treated with reverence. In contrast, Euroamerican beliefs and practices have changed a great deal over the years. Many 19th century Americans, including the writer of Van Buren County's 1879 county history, believed that burial mounds and other earthworks were the monuments of an extinct people that had lived in North America prior to the arrival of the Native Americans. This notion gave rise to the romanticized, but unfortunately racist, myth of "the Mound Builders" and led, equally unfortunately, to the widespread opening and looting of mounds (Silverberg, 1968). However, by the time Starr's initial report on the archaeology of Iowa appeared, the Smithsonian Institution's Bureau of American Ethnology had begun a

systematic, scientific survey of the prehistoric earthworks of the Upper Midwest (Thomas, 1894). This survey administered a lethal dose of reality to the Mounder Builder myth, proving that the mounds were built by descendants of modern Native Americans and not by lost tribes or vanished races (Willey and Sabloff, 1993:47-49). Subsequently, interest in mounds among Euroamericans turned to the anthropological study of Native American mortuary customs, and to the demographic and physiologic analysis of the human remains they contained.

Figure 2. Photograph of a burial mound near Shelter #2 in Lacey-Keosauqua State Park.

Geologists and soil scientists also became interested in mounds, seeing in their earthen fill evidence for rates of soil formation. Leighton (1929) and McComb and Loomis (1944) were among the first to observe that the soils developed in mound fill were more weakly developed, and therefore much younger, than adjacent soils formed in late Wisconsinan loess. In a benchmark study of soil genesis, Parsons et al. (1962) inferred the rate at which soil horizons formed in mounds ranging in age from 1000 to 2500 years. They compared the properties of soils formed in mounds in northeast Iowa to those of adjacent Fayette-series soils formed in late Wisconsinan loess. They concluded that a humus-enriched topsoil (A horizon) very similar to that found in the 14,000 year old, loess-derived soils could form in mounds within 1000 years. The underlying eluvial layer (E horizon), however, was only minimally developed after 1000 years, becoming moderately well expressed within 2500 years. In mound fill, B (subsoil) horizons developed the structure and color of off-mound B horizons within 2500 years, and began to develop clay films, indicative of the downward translocation and accumulation of clay.

In return for borrowing a chronology from archaeologists, Parsons et al. (1962) contributed to the understanding of prehistoric mound building techniques. They noted that mound fill, emplaced by the prehistoric builders, usually overlay an abrupt boundary with a B horizon that was identical to the off-mound B horizon. They inferred that the first stage in mound construction was the removal of the topsoil, followed by emplacement of fill on the truncated soil surface. This construction sequence, with variations, was subsequently confirmed by other,

interdisciplinary studies of mound stratigraphy (e.g., Bettis, 1988; Benn and Bettis, 1977; Benn et al., 1978).

Beginning in the mid-to-late 1970s, American Indians grew increasingly affronted by the exhumation of their ancestors in the name of science. Archaeologists and anthropologists came to accept this view (e.g., Anderson et al., 1978), and state and federal legislation was enacted to protect and preserve Native American burial sites from disturbance, including archaeological excavation. Iowa was the first state to enact such legislation, in 1976, making it an aggravated misdemeanor to knowingly disturb any human burial without lawful authority, regardless of the burial's age, and whether on private or public land (Iowa Code Chapter 716.5). This legislation gave statutory authority over burials more than 150 years old to the Office of the State Archaeologist (Iowa Code Chapter 263B; Iowa Administrative Code 685-11). The staff of the Burials Program at the Office of the State Archaeologist is dedicated to advising and consulting with developers, agencies, and the public on matters concerning prehistoric burials.

Professional ethics among archaeologists today strongly discourage and usually prohibit the excavation of prehistoric mounds except under exceptional circumstances, and then only with extensive coordination with Native American spiritual leaders. Unfortunately, Native American beliefs about, and appreciation for, the mounds were not recognized by Euroamerican culture until hundreds of thousands of the features had been destroyed. However, in some cases (albeit all too infrequently) practices that disturbed mounds later contributed to the preservation of others. Thus, Parsons' studies of soil genesis in mounds provided archaeologists with a powerful, but noninvasive set of criteria for identifying, and therefore preserving prehistoric earthworks. Today, the most common method for determining whether a mound-like bump on the landscape is natural or cultural in origin is to use a small diameter coring tool (often only ¾ to 1 inch in diameter) to compare the "natural soil, developed off the mound, with the soil developed beneath the mound top. The comparison is made using the pedologic criteria of horizonation, ped coatings, and structural development observed in mound fills by Parsons et al. (1962) and others. Currently, methods utilizing ground penetrating radar are under development (Whittaker and Storey, 2004) and hold great promise for the noninvasive ground-truthing of suspected mounds.

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QUATERNARY GEOLOGY OF LACEY-KEOSAUQUA STATE PARK

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REGIONAL SETTING AND GEOLOGIC HISTORY

Lacey-Keosauqua State Park is located in Van Buren County, wrapping around the south side of the bend in the Des Moines River. Van Buren County is within the Southern Iowa Drift Plain (Prior, 1991), which is the largest landform region of Iowa and makes up most of the southern half of the state (Figure 1). The area around Lacey-Keosauqua shows the characteristic steeply rolling landscape and well-established drainage divides of the Southern Iowa Drift Plain. This

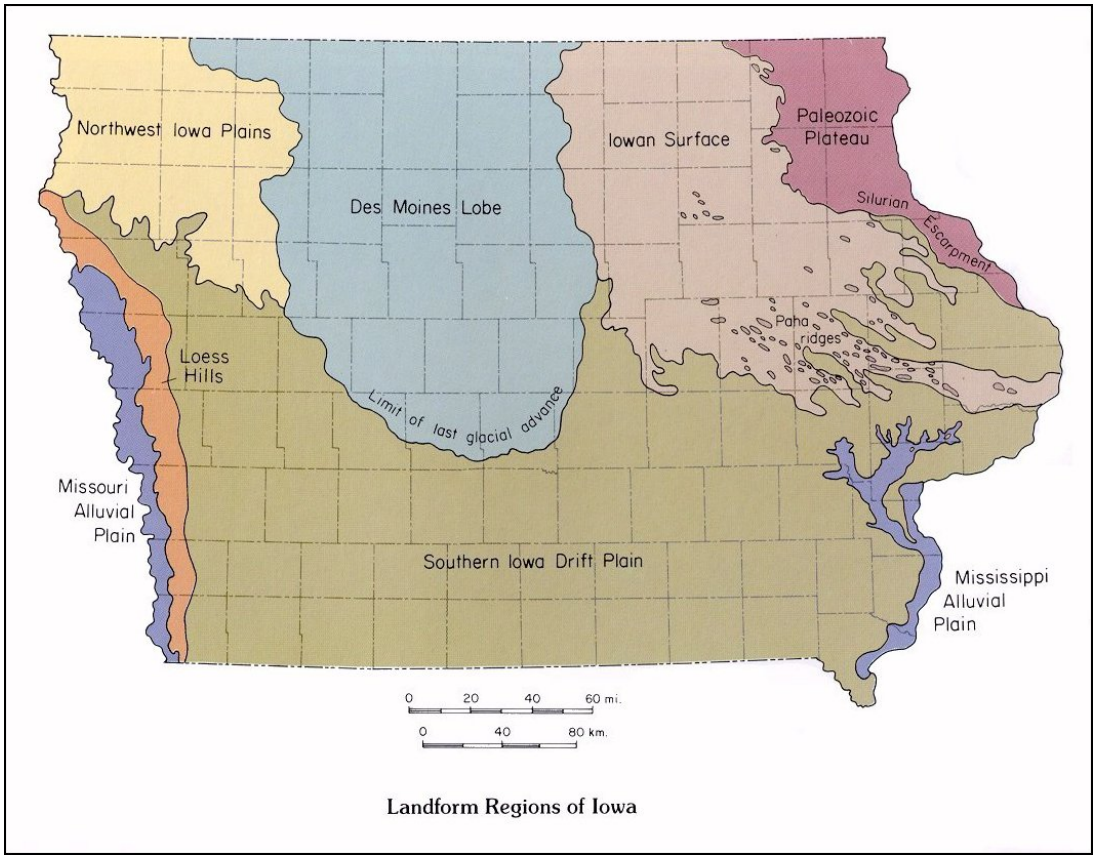

Figure 1. Landform Regions Map of Iowa.

region of the state was glaciated numerous times during the Pre-Illinoian, with the last episode approximately 500,000 years ago (Hallberg, 1980). The subsequent Illinoian and Wisconsin glacial ice advances did not reach the areas around Van Buren County, but did have an impact on the development of the area due to the effects from the associated glacial meltwater. Surficial processes since the Pre-Illinoian have erased the characteristic features typically associated with glacial deposits (moraines, kettles, kames, etc.) and have led to the landscape we see today. Episodic periods of rapid erosion and downcutting shaped the landscape leaving behind stepped erosional surfaces of varying age. Alternately, intervals of relative landscape stability allowed soil profiles to develop in the exposed glacial deposits. These processes have left behind a well integrated drainage network with fairly narrow upland divides.

A windblown mantle of loess and eolian sand was deposited at the surface as the landscape was developing. The Peoria Loess comprises most of this mantle in the eastern portion of the Southern Iowa Drift Plain. Peoria loess accumulation occurred episodically from 21,000 to 12,000 B.P., blanketing most of the state at this time with maximum thicknesses adjacent to river valleys. Closer to the Mississippi River Valley, the Peoria materials may be underlain by the Roxana Silt, an older eolian unit that accumulated from 55,000 to 27,000 B.P. (Leigh and Knox, 1993).

The Des Moines River runs down the axis of the Des Moines Lobe and across the Southern Iowa Drift Plain in the southeast part of the state. It is uncertain how long the Des Moines River has occupied the valley, but its likely origin is related to Pre-Illinoian glacial activity. The Des Moines River Valley is one of the longest river valleys in the state of Iowa, and drained the Des Moines Lobe during and after the Wisconsin glacial.

Little work has been conducted on the Des Moines River in Van Buren County, but evidence from north-central Iowa suggests that the current configuration of the Des Moines River Valley developed with the retreat of the last phases of the Des Moines Lobe (between 14,000 and 11,000 years ago) carrying large amounts of glacial meltwater. From 13,500 to 12,600 B.P. the Des Moines Lobe glacier stagnated and a sag developed that later became the Des Moines Valley in north-central Iowa (Bettis and Hoyer, 1986). By 12,300 B.P. the Des Moines River Valley was acting as a major meltwater and outwash channel for the Des Moines Lobe. Until 11,000 B.P. multiple episodes of downcutting occurred that resulted in the formation of a series of terraces and benches. Based on topographic maps and the soils survey, numerous terrace levels appear to be present near Lacey-Keosauqua State Park. Presumably these are associated with the complex history of the Des Moines River Valley, but the stratigraphy and timing has not been sorted out.

GEOLOGY OF LACEY-KEOSAUQUA STATE PARK

The county wide soils map for the region (Dietz and Hidlebaugh, 1962) indicate that broad uplands in the area are loess mantled till plains, with exposures of paleosol and till in the drainages. Curiously, no till could be located within the park. The only evidence of glacial activity within the park comes from the abundance of erratics, some of them several feet in diameter (Figure 2). A variety of igneous and metamorphic lithologies are represented, giving evidence of the great distances these materials were transported. Based on drilling logs, the till thickness is highly variable, ranging from 30 to over 150 feet. The till is Pre-Illinoian in age and is either the Wolf Creek Formation or the older Alburnett Formation (Hallberg, 1980). The paleosols in this area are well-developed and are either Yarmouth-Sangamon or Late Sangamon in age. Information from boring logs suggests the paleosol may be up to twenty feet thick in some locations.

Figure 2. Large glacial erratic in Duckworth Creek.

Loess is found throughout the park and is exposed in most drainages. The loess overlies bedrock and may have a thin paleosol or colluvial materials intervening. A weak stone line is present at several locations. At least eight feet of loess is exposed in one stream bank along Duckworth Creek. The lower portion of the loess at this location is loaded with organic debris, indicating a period of landscape stability. Striplogs in the area indicate a maximum

thickness of twenty feet for loess in the area, but thicker loess may be found locally, especially near the river. Loess thickness typically varies between five and ten feet, and many logs also show till or paleosol at the surface. Based on these records and observations within the park, the thickness and distribution of loess is not well constrained. Older stratigraphic records (Gordon, 1894) and more recent geologic data generally indicate that the loess is thickest near the Des Moines River.

A series of terraces are evident by looking at the topography and soils in the area. These are presumably associated with the drainage history of the Des Moines Lobe, although little is known specifically about their characteristics and history. Holocene age materials are also found within the river valley and drainages.

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BEDROCK GEOLOGY OF LACEY-KEOSAUQUA STATE PARK

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INTRODUCTION

Lacey-Keosauqua State Park preserves a beautiful segment of the Des Moines River Valley in central Van Buren County, along the outer channel margin of the river's "Big Bend." Exposures of Paleozoic bedrock strata are common in the park, especially in the picturesque wooded bluffs bordering the river, and in the steep ravines and rocky stream drainages that flow into the river from the south and west. The reader is encouraged to read a concise summary of the park's geology by McKay (1997), published in Iowa Geology and retrievable from the Iowa Geological Survey's website (www.igsb.uiowa.edu).

Most of the exposed bedrock in the park belongs within the Mississippian Subsystem (Figure 1), a name derived from exposures along the Mississippi River in southeast Iowa downstream into Illinois and Missouri. Mississippian strata exposed in Lacey-Keosauqua Park include the youngest Mississippian strata preserved in Iowa, assigned to the "St. Louis" and Pella formations. Dominated by beds of sandstone and limestone, these strata were deposited in a variety of tropical environments, including shallow tropical seas, nearshore environments, and rivers and estuaries. At the time these sediments were being deposited, about 325 to 335 million years ago, Iowa lay within an arid tropical climatic belt in low southern latitudes (North America occupied a more southerly global position than it does today). The great seas that had flooded vast areas of the North American continental interior earlier in the Mississippian (and characterized in Iowa by deposition of the Burlington and Keokuk formations) were beginning to shallow and slowly retreat from the Iowa area by the time the "St. Louis" and Pella beds were being deposited in southeast Iowa. These upper strata belong within the Middle Mississippian Meramecian and lower Chesterian Series (mid Visean).

As the Mississippian seas withdrew from the area, Iowa was exposed to a prolonged episode of continental erosion, and a profound erosional surface (or unconformity) was developed. This erosional episode lasted for over 10 million years, creating a landscape of incised valleys and karstic terrains on Mississippian (and older) strata in the Iowa area. This surface is evident in stream drainages southward in Lacey-Keosauqua Park, where eroded Mississippian limestone beds are overlain by strata of Pennsylvanian age.

Shallow seas, once again, began to encroach into the Iowa area during Pennsylvanian time, resulting in a new episode of sediment accumulation beginning around 310 million years ago. River systems aggraded in response to nearby changes in sea-level, swampy lowlands were flooded, and shallow-marine sediments accumulated nearshore. Because of gradual continental movement, Iowa had drifted from an arid tropical climate belt (Mississippian) into a humid equatorial climate belt. The style of sediment accumulation reflects these climatic changes, and Pennsylvanian strata in Lacey-Keosauqua Park are dominated by relatively soft gray mudstones and shales containing one or more beds of coal. Tropical soils ("underclays") can also be seen in the park. The Pennsylvanian "coal measures" are extensively distributed across southern Iowa, but approach their eastern limits in Van Buren County. Description and discussion of the various bedrock strata seen in the park follows.

MISSISSIPPIAN – "ST. LOUIS" FORMATION

The succession of strata in southeastern Iowa that has long been referred to as the St. Louis Formation by most Iowa geologists (e.g., Van Tuyl, 1925), lies above a major intra-Mississippian

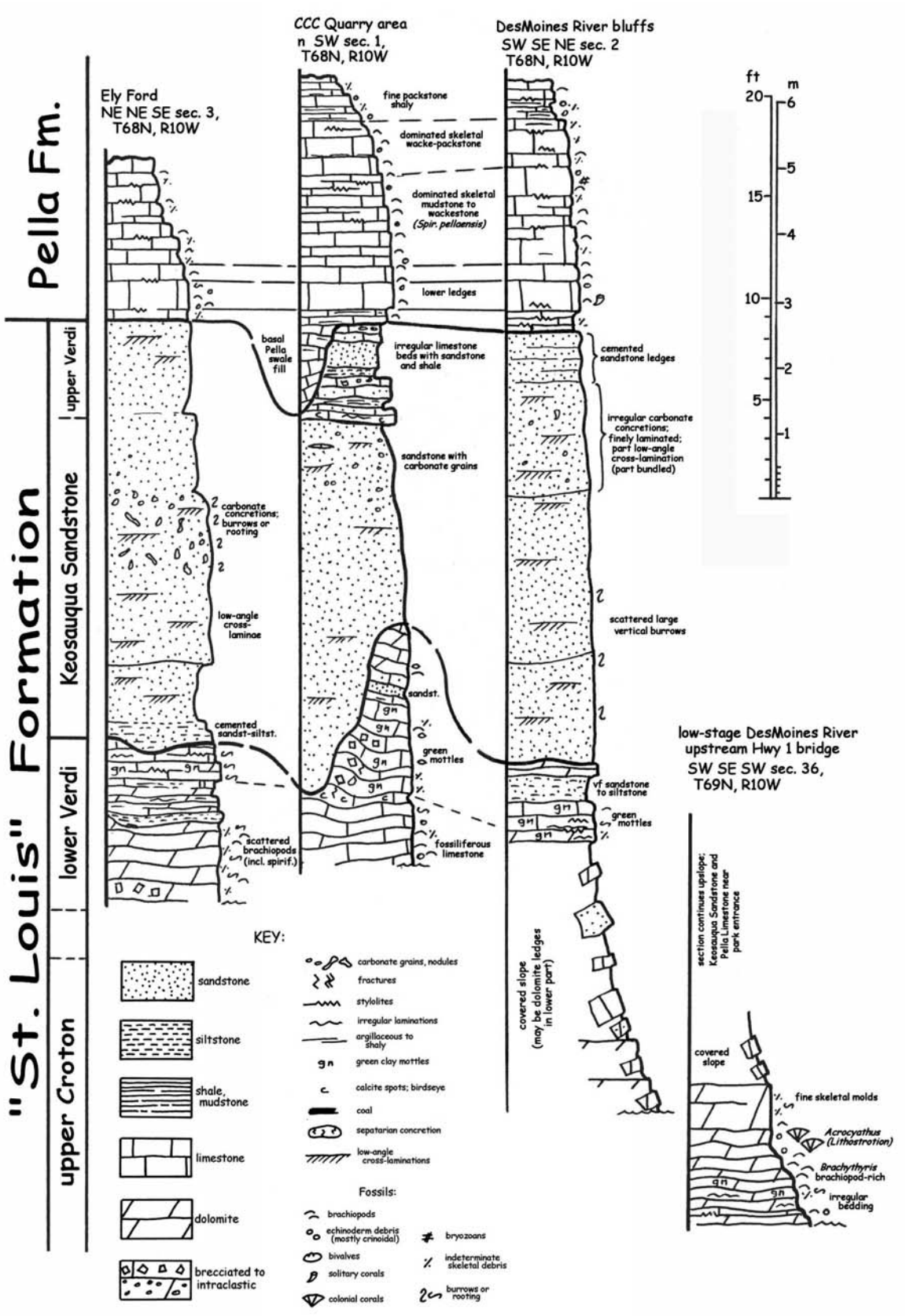

Figure 1. Mississippian Strata of Lacey-Keosauqua State Park, Van Buren County, Iowa.

erosional unconformity (developed on the Augusta Group) and below the Pella Formation. This usage resulted from the presumed correlation of these strata in Iowa with a limestone-dominated succession seen to the south in the St. Louis area. However, McKay et al. (1987) and Witzke et al. (1990) suggested that a large portion of this so-called St. Louis succession does not correlate biostratigraphically with type St. Louis strata, and, in addition, the southeast Iowa section is lithologically quite dissimilar to the type St. Louis section (especially with the abundance of sandstone, dolomite, and evaporites seen in Iowa). In particular, it appears likely that the upper half of the Iowa "St. Louis" section is entirely of post-St. Louis age, correlating instead with younger strata in Missouri and Illinois referred to the Ste. Genevieve Formation. These significant differences indicate that the term "St. Louis" probably has been misapplied to strata in Iowa, and the term should be replaced by other more appropriate terminology for the Iowa stratigraphic succession. A reclassification of these strata has not yet been published, and, as proposed by Witzke et al. (1990), use of the term in quotes ("St. Louis") seems appropriate pending a more complete study. If and when the term "St. Louis" is dropped from usage in Iowa, it likely will become necessary to separately classify upper and lower units in this interval. Van Tuyl (1925) recognized lower and upper "St. Louis" units in southeast Iowa, which he termed the Croton and Verdi members, respectively. One solution would be to formalized these units as separate formations, the Croton and Verdi, each with constituent members.

Croton Member

The Croton Member encompasses the lower part of the "St. Louis" interval in Lacey-Keosauqua Park, exposed primarily in the low river banks (seen at low river flow) along the Des Moines River just upstream from the Highway 1 bridge. The Croton Member was named by Van Tuyl (1925) for exposures at Croton, Iowa, downstream from Keosauqua along the Des Moines River in Lee County. Exposures in the park, beginning at river level, primarily represent the fossiliferous dolomite and limestone beds of the upper Croton Member. The stratigraphy and correlation of the Croton Member are discussed by Witzke et al. (1990). The Croton Member apparently correlates with the true St. Louis Formation of Illinois and Missouri.

The Croton Member is dominantly a carbonate interval, characterized by dolomite and limestone strata, part sandy to argillaceous. The Croton Member in southeast Iowa is seen in two general "phases," as discussed by VanTuyl (1925): brecciated and "undisturbed." In many sections outside the park, some Croton strata are highly fractured, broken up into angular blocks and clasts, forming brecciated masses of varying scale. However, the brecciated and broken Croton phase can be abruptly replaced by more regularly-bedded strata over short distances. In Lacey-Keosauqua, the Croton is not extensively brecciated, but it nonetheless displays fracturing and irregular bedding (in large swales with gently dipping surfaces) that probably formed during regional brecciation and solution collapse of interbedded evaporites in the lower Croton. The solution of interbedded gypsum and anhydrite likely occurred not long after deposition. The removal of these soluble beds reduced volume, resulting in collapse and fracturing in the overlying carbonate beds.

Figure 2. Photo of an *Acrocyathus* coral from the Croton Mbr, Lacey-Keosauqua State Park.

Upper Croton strata exposed near the Highway 1 bridge in Lacey-Keosauqua Park are dominated by dolomite beds, many displaying molds of fossils

and fine skeletal debris. In some beds, molds of brachiopods are scattered to abundant, primarily *Girtyella* and a relatively smooth-shelled spiriferid (cf. *Brachythyris*). Crinoid debris is scattered to common in these strata. Burrows are also present, and some of the lower beds display interesting green clay fills, some apparently lining or filling burrow systems. The upper beds contain scattered specimens of a large (to 20 cm) colonial rugose coral (Figure 2) belonging to the genus *Acrocyathus* (usually listed as "*Lithostrotion*" in the older literature). These corals are completely silicified (replaced by silica) and are quite spectacular in their preservation. Chert and chalcedony masses are also scattered in these strata. Low in the exposed section, faintly-laminated dolomitic limestone and limestone beds are seen, the latter seen as skeletal mudstone to wackestone (with crinoid debris and brachiopods).

Sections exposing the highest beds of the Croton Member in contact with overlying Verdi strata have not yet been identified in the park, and this interval seems to be mostly covered by colluvial slopes and a narrow low terrace along the river bluffs in the downstream reaches of the park. Nevertheless, an exhaustive exploration of the streams and ravines in this part of the park has not been completed, and it is possible that parts of this covered interval may be identified in outcrop. Elsewhere in Van Buren County, the highest beds (4 to 8 ft) of the Croton include laminated carbonate mudstones, stromatolitic limestone, and breccias (R. McKay, 2004, personal communication). Of note, all of these lithologies have been identified as colluvial blocks along the lower bluffs in the park, and it is likely that these blocks were derived from the uppermost Croton Member. The Croton is abruptly overlain by fossiliferous marine carbonate beds of the basal Verdi Member.

Lower Verdi Member

The "Verdi beds" were named by Bain (1895) for exposures in Washington County. Van Tuyl (1925) equated the Verdi with the "upper St. Louis," and the Verdi could be elevated as a formational term for this interval. As discussed by McKay et al. (1987) and Witzke et al. (1990), the Verdi succession apparently does not correlate with the St. Louis Formation of Illinois and Missouri, but more likely correlates with the lower part of the Ste. Genevieve Formation in that area. The lower beds of the Verdi Member are well displayed at a number of localities in Lacey-Keosauqua State Park, lying unconformably beneath the Keosauqua Sandstone.

The Verdi Member is characterized by a complex and interbedded succession of dense limestone, dolomite, and sandstone. Lower Verdi strata seen in Lacey-Keosauqua Park include fossiliferous limestone and dolomite, green-clay mottled (some filling burrows) limestone and dolomitic limestone, dense limestone with calcite spots, and minor interbedded sandstone and siltstone. In many sections, these strata show irregular bedding in broad swales, with low to moderate dips; in places, the beds are fractured to slightly brecciated. The irregular bedding and brecciation likely resulted from evaporite solution collapse within the underlying Croton Member. The succession of beds in the lower Verdi of the park constrain a general shallowing-upward depositional sequence, with fossiliferous open-marine carbonate beds in the lower part, and more restricted shallow-marine to nearshore depositional facies upsection.

The lowest beds of the lower Verdi seen in Lacey-Keosauqua State Park are the most fossiliferous, characterized by skeletal lime mudstones to wackestones (part recrystallized) and their dolomitized equivalents. Fossils include several kinds of brachiopods, crinoid debris, ostracodes, and indeterminate skeletal fragments. Brachiopods seen in the park tentatively include smooth-shelled terebratulids *(Dielasma*, *Girtyella*), a small rhynchonellid (cf. *Pugnoides*), and a spiriferid (cf. *Brachythyris*). The upper beds of the lower Verdi include fossiliferous crystalline limestone and dolomite (with indeterminate brachiopods, ostracodes, skeletal debris, and burrows), green clay mottled limestone and dolomite, sandy carbonate beds, and discontinuous thin beds of very fine sandstone to siltstone.

Significant erosional incision followed deposition of the lower Verdi beds, with up to 10 feet (3 m) of erosional relief seen at places within Lacey-Keosauqua State Park, especially

downstream from the CCC Quarry. This erosion likely resulted from lowered base levels as the shallow seas withdrew from the area, and river systems transected the region. The succession of Verdi strata elsewhere in southeast Iowa display a complex of smaller-scale marine and marine-influenced depositional cycles, including peloidal to skeletal limestones capped by sandy beds, sandstone, and supratidal to restricted-marine carbonate facies. In Lacey-Keosauqua Park, however, these carbonate cycles are not preserved, and a prominent sandstone body, the Keosauqua Sandstone, occupies the position of the middle and upper Verdi Member.

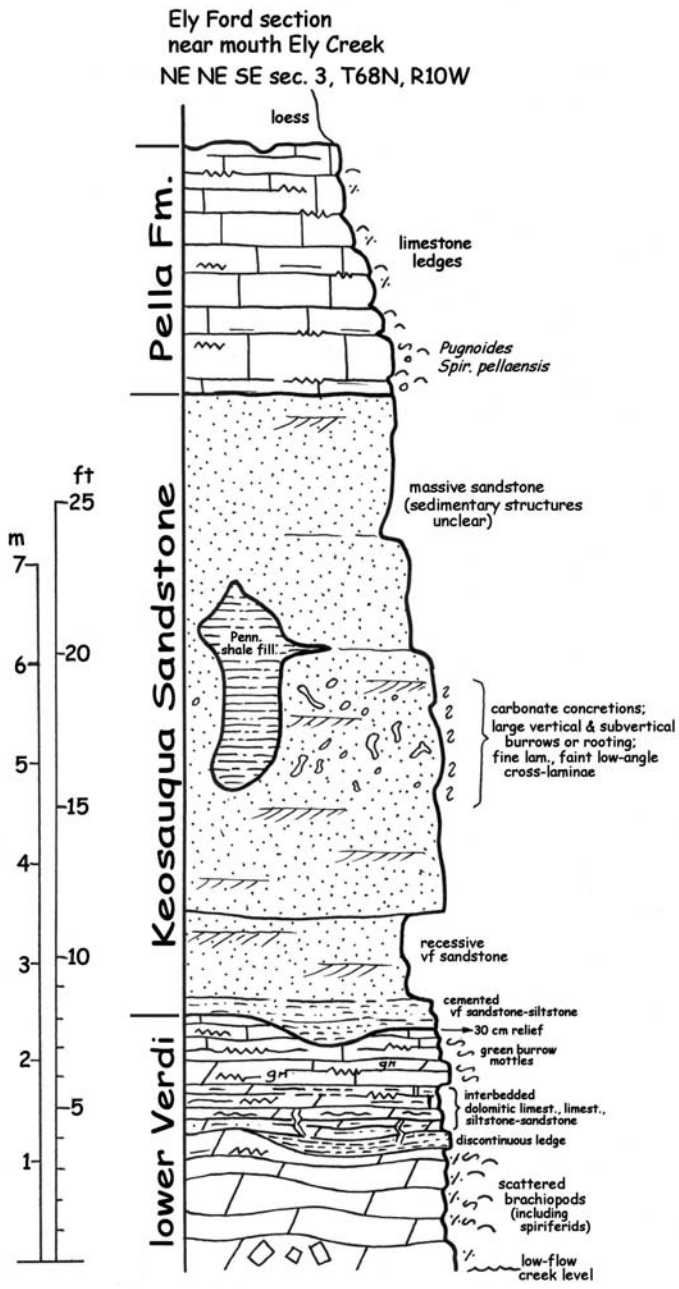

Figure 3. Mississippian rock section exposed at Ely Ford, Lacey-Keosauqua State Park (see Figure 1 for key to symbols).

Keosauqua Sandstone

Multiple sandstone units are recognized in the "St. Louis" succession of southeast Iowa at various stratigraphic positions. Many of these sandstones are geographically discontinuous, and their correlations are unclear. Some of these sandstones may have been deposited in channel systems created by fluvial (river) incision, and subsequently filled by aggradation of riverine sediment in fluvial and estuarine systems. Other "St. Louis" sandstones probably were deposited in nearshore shallow-marine settings, marking the influx of riverine sediments into the shallow sea. At least one "St. Louis" sandstone has been broadly correlated in parts of southeast Iowa, and has been given a formal stratigraphic name, the Yenruogis Sandstone Member (Witzke et al., 1990).

The prominent sandstone seen in the bluffs, creek valleys, and ravines of Lacey-Keosauqua State Park was termed the "Keosauqua sandstone" by Gordon (1895, p. 217). Although this sandstone seems largely restricted geographically to the Keosauqua area, it nonetheless is a prominent and noteworthy stratigraphic unit within the "St. Louis" succession of the area, and it seems appropriate to recognize this sandstone as a distinctive unit. Ideally, it is hoped that all sandstone bodies within the "St. Louis" will be stratigraphically constrained and uniquely identified. Recognition of the Keosauqua Sandstone as a member within the "St. Louis" succession is a step in that direction.

The Keosauqua Sandstone (Figure 3) varies from about 10 to 25 feet (3-7.5 m) in thickness in the park, and it is dominated by very fine to fine-grained quartz sandstone. Some coarser grains are present in some beds, especially coarse carbonate grains, but also including some medium-grained sand. The sandstone beds are cemented by calcite to varying degrees, and cemented ledges are locally prominent in the basal and upper parts. Additional lithologies are identified within the sandstone, including carbonate (limestone) concretions and nodules, limestone clasts (sand to gravel-sized), and rare thin discontinuous limestone beds (part sandy).

Figure 3. Exposure of Keosauqua Sandstone along creek at Ely Ford, Lacey-Keosauqua State Park.

The Keosauqua Sandstone internally displays large-scale channel-forms and troughs. Sedimentary structures within the fine sandstones commonly include fine horizontal laminations to low-angle cross-laminations. Some larger trough and planar crossbeds are locally present. In places, the laminations appear to be grouped into thickening-and-thinning bundles (5-10 cm thick) suggestive of tidally-influenced deposition. More puzzling features seen in the sandstone include a variety of irregular carbonate nodules (Figure 4) and fills, best displayed in the middle sandstone near Ely Ford, but also seen in the lower to middle sandstone elsewhere in the park. Some of these carbonate nodules are small (< 2 cm) and show considerable variation in abundance laterally and vertically in the sandstone. At Ely Ford, some of the carbonate concretions and fills are quite large (up to 5-10 cm diameter, 10-30 cm long), forming vertical to sub-vertical burrow-like structures (Figure 5). The identification of these structures is uncertain, but some of them resemble large burrows or rooting. It is possible that the carbonate nodules and concretions represent rhizocretions, soil-formed carbonates developed along the roots of trees. However, the vertical features do not show extensive root-like penetrations, and, in addition, no exposure surface is seen in the sandstone succession above (where trees could grow). Instead

they are seen within laminated sandstone strata, in places with possible tidal bundling. Another possibility is that at least some of these concretions represent burrow fills, formed by aquatic organisms in an estuarine system. Some of the larger subvertical structures seen at Ely Ford resemble structures identified elsewhere as lungfish burrows. Although difficult to verify, it is noteworthy that lungfish fossils have been identified in upper "St. Louis" strata in Keokuk County (see Witzke et al., 1990), so we do know that lungfish lived in the region.

Figure 4. Photo of concretions in the Keosauqua Sandstone at Ely Ford, Lacey-Keosauqua State Park.

Figure 5. Large subvertical structures in the Keosauqua Sandstone at Ely Ford.

In much of the park, the Keosauqua Sandstone is directly overlain by fossiliferous limestones of the Pella Formation. However, in the area of the CCC Quarry, an interval about 5 feet thick below the Pella includes an irregularly interbedded succession of limestone, sandstone, siltstone, and shale. The limestone beds are variably sandy, intraclastic to conglomeratic, or finely brecciated, and they are displayed in broadly undulating swales, locally showing erosional truncation internally. Some of the limestone contains small calcite spots, possibly "birdseye" structures suggestive of supratidal mudflat deposition. This interbedded limestone interval seems to occupy the position of the uppermost Keosauqua Sandstone, and the interval may represent marginal shoreface and shallow-water deposition within a tidal channel. Elsewhere in Van Buren County, a similar interval of interbedded carbonate and sandy strata below the Pella has been included within the upper Verdi Member (R. McKay, 2004, pers. comm.), as followed here.

Strata of the Keosauqua Sandstone and upper Verdi are erosionally beveled beneath the Pella Formation in the park, probably related to an episode of subaerial and fluvial erosion at the close of upper "St. Louis" deposition. Of note, upper "St. Louis" strata westward in Keokuk County include nonmarine and lacustrine (lake) deposits, and karstic-collapse fills, with a remarkable vertebrate fauna including a variety of fish as well as tetrapods (early four-legged animals) (see McKay et al., 1987; Witzke et al., 1990). It is possible that part of the Keosauqua Sandstone may represent estuarine or fluvial systems contemporaneous, in part, with the vertebrate-bearing strata to the west.

MISSISSIPPIAN – PELLA FORMATION

The highest Mississippian strata exposed in the park, as well as elsewhere in Iowa, belong to the Pella Formation. Limestone ledges of the Pella Formation are beautifully exposed in Lacey-Keosauqua State Park, especially in the historic CCC Quarry. Bain (1895) named the "Pella beds" for the highest Mississippian stratigraphic unit in Iowa, the name derived from exposures near Pella in Marion County. Various geologists have drawn the base of the Pella Formation at several stratigraphic positions, and sandstone strata beneath the upper fossiliferous limestone and shale interval have been included within the Pella in many geologic reports and well logs. Witzke et al. (1990) restricted the definition of the Pella, removing lower sandstones to the upper "St. Louis." In this definition, the Pella Formation in Lacey-Keosauqua Park is the interval of fossiliferous limestone that rests unconformably on upper Verdi and Keosauqua Sandstone strata. The erosional contact locally shows up to 5 feet of relief. The Pella Formation probably

correlates with the upper Ste. Genevieve Formation of Illinois and Missouri (ibid.). In fact, the "Pella beds" were included within the Ste. Genevieve Formation by Van Tuyl (1925). The Ste. Genevieve is now included within the basal Chesterian Series (Lane and Brenckle, 2001).

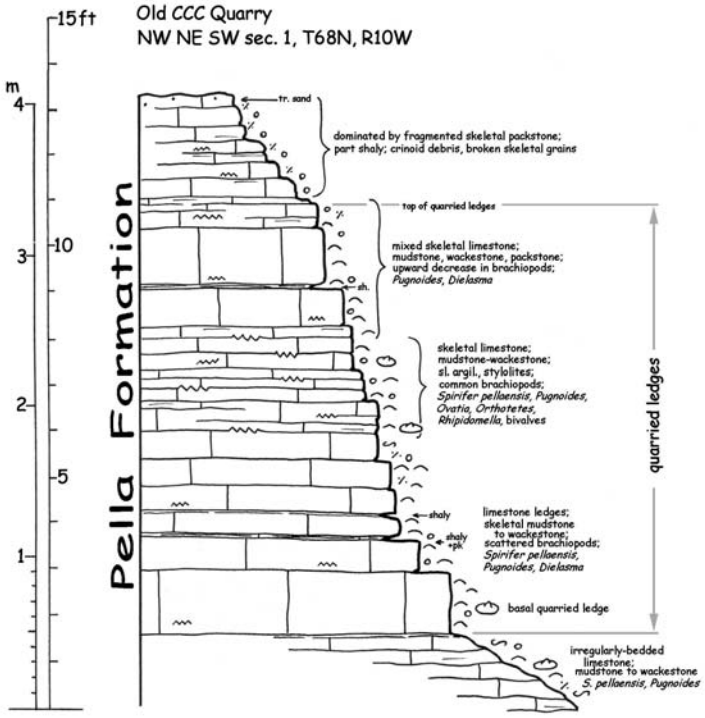

Figure 6. Graphic sections of the Pella Formation rocks exposed at the CCC Quarry, Lacey-Keosauqua State Park.

In the park and nearby areas of southeast Iowa, the Pella is characterized by dense fossiliferous limestone, commonly in regular beds. Thin shales or shaly limestone separate some beds, and shaly interbeds generally increase upwards. Stylolites are scattered to common. Westward in southeast Iowa, the Pella is locally thicker and includes an upper fossiliferous calcareous shale (marl) unit. The limestone-dominated eastern facies of the Pella Formation is exposed in Lacey-Keosauqua State Park, and the CCC Quarry in the park (Figures 6 and 7) is designated herein the primary reference section for this regional facies of the formation.

As seen in the area of the CCC Quarry, a basal limestone interval up to 5 feet thick locally occupies a swale or channel incised into upper "St. Louis" strata. The margin of this unit is seen to truncate upper Verdi strata just upstream from the quarry. This interval is dominated by irregularly-bedded limestone, primarily skeletal mudstone to wackestone, and slightly argillaceous. The beds are fractured and contorted to varying degrees, locally showing slickensides. These basal Pella beds are sparingly fossiliferous, and brachiopods ("*Spirifer*" *pellaensis*, *Pugnoides ottumwa*), crinoid debris, clams, and burrows are recognized.

Above this basal Pella unit and directly overlying upper "St. Louis" strata at most localities in the park, regularly-bedded limestone ledges of the lower Pella are prominent. The bedding is so regular, that individual beds can be recognized throughout much of the park. The lower 6 or 7 feet of this lower Pella interval are dominated by dense skeletal mudstones and wackestones, with minor packstone. These beds are slightly argillaceous and stylolitic, especially upward. The lower Pella contains a moderately diverse fossil fauna, visually dominated by well-preserved brachiopod fossils, commonly seen as whole shells. Other fossils are also seen in the park, including moderately abundant clams (molds sometimes seen in life position), scattered to common echinoderm debris (primarily crinoid grains, but also including echinoid spines and plates), rare gastropods (snails), bryozoans, and solitary corals. The beds display some burrowing, including some large (2 cm diameter) horizontal burrows made by an unknown burrowing organism. Further study is needed to identify the calcareous microfossils in the eastern limestone facies of the Pella Formation.

Figure 7. The CCC Quarry at Lacey-Keosauqua State Park is designated as the primary reference section of the limestone-dominated eastern facies of the Pella Formation.

The brachiopod fauna of the lower Pella in Lacey-Keosauqua Park is of particular note, dominated by specimens of the distinctive spiriferid brachiopod, "*Spirifer*" *pellaensis* (the genus name is placed in quotes, as modern taxonomic treatment of this taxon is unavailable; recently the species was included within *Anthracospirifer* [McKay et al., 1987], but this assignment also does not seem satisfactory). Other brachiopods are also noteworthy, especially the small ribbed rhynchonellid *Pugnoides ottumwa*, and smooth-shelled terebratulids (*Dielasma formosum*, *Girtyella* sp.). Rarer brachiopods in these beds include the strophomenid *Orthotetes* sp., two or more productids (*Ovatia ovata*, ?*Protoniella* sp.), another spiriferid (cf. *Brachythyris* sp.), an athyrid (*Composita* sp.), and a previously unrecognized orthid (cf. *Rhipidomella* sp.).

The upper part of the Pella Formation in the park (up to about 5 feet thick) contrasts with the lower beds. This upper interval becomes more irregularly bedded upward, and includes a mixed succession of skeletal wackestone to packstone. The upper few feet are dominated by fragmented skeletal packstone, partly shaly, containing an abundance of broken skeletal grains (and rare quartz sand). The upper part of the Pella shows an upward loss of brachiopods, these beds also lacking the distinctive Pella brachiopod "*Spirifer*" *pellaensis*. In general, the upward decrease in mud content and the upward increase packstones and grain abrasion characterizes a shallowing-upward succession, ranging from subtidal deposition into more turbulent shallow-marine shoals or strongly storm-influenced settings. This shallowing-upward succession undoubtedly culminated in the progradation of nearshore and supratidal facies across southeast Iowa, but the final regressive phases of Pella deposition are not preserved in southeast Iowa. The absence of such Pella facies, and all post-Pella Mississippian strata in Iowa, is due to an extensive period of post-Pella pre-Pennsylvanian erosion. Within Lacey-Keosauqua Park, the Pella is deeply eroded along an irregular surface beneath Pennsylvanian strata.

PENNSYLVANIAN – LOWER CHEROKEE GROUP

The post-Pella erosional episode represents a prolonged period (approximately 10 million years in length) for which we have no depositional record. Pennsylvanian strata can be seen overlying an eroded Pella surface in Lacey-Keosauqua Park primarily in streamcuts scattered in the southern part of the park (at elevations generally above 600 feet). Because of deep weathering along this sub-Pennsylvanian erosional surface, Pennsylvanian sediments can also be seen locally in crevices and fills within the Pella and upper "St. Louis" formations in the park. Across southeast Iowa, Pennsylvanian strata are seen to overlie various Mississippian and Devonian bedrock units, demonstrating regional uplift and erosional truncation of older Paleozoic strata to the northeast.

The Pennsylvanian bedrock in the park is assigned to the Cherokee Group, a thick succession of coal-bearing strata, dominated by gray mudstone and shale with sandstone channels and minor limestone, primarily deposited in nonmarine (river, swamps, soils,) and marine (shallow-marine, nearshore, estuarine) settings. No biostratigraphic studies (coal palynology, marine microfossils, conodonts) have been undertaken on Pennsylvanian strata exposed in Van Buren County, so the exact correlations of these beds with the better-known Cherokee succession in south-central Iowa remain unknown. It is probable that these strata belong within the lower Cherokee Group (possibly the part that belongs within the Middle Pennsylvanian Atokan Series).

In general, the succession of Cherokee strata in Iowa was deposited in response to the rise and fall of sea-level associated with the waxing and waning of continental ice sheets in the southern hemisphere (producing cycles of deposition called 'cyclothems'). Rivers aggraded in response to rising sea level, and shallow seas encroached across the region flooding up valleys (estuaries) and coastal swamps (forming coals). The marine and estuarine muds are generally dark and organic-rich, apparently deposited in stratified settings under low-oxygen to anoxic bottom conditions. In more hospitable settings, shelly creatures (clams, brachiopods) inhabited the shallow seas. As global sea-level dropped, Iowa became emergent once again, river systems incised across the landscape, and widespread soil formation took place in the wet equatorial climate.

The succession of Pennsylvanian bedrock strata in Lacey-Keosauqua Park (Figure 8) is not particularly well displayed, but a general succession can be pieced together from exposures in the park (especially along the drainages of Wesley and Duckworth creeks). A lower interval of gray mudstone and siltstone is seen in places to overlie the eroded Pella Limestone, locally resting as low as the upper Keosauqua Sandstone. In general, the Pennsylvanian section appears to truncate Mississippian strata southward in the park. The upper part of this lower unit is locally seen to be modified by ancient soil-forming processes, shown by color changes (pale to reddish), abundant slickensides, and rooting. These clay-rich paleosoils are often termed "underclays," as they commonly underlie coals. In the park, this underclay is capped by a thin coal to coaly shale.

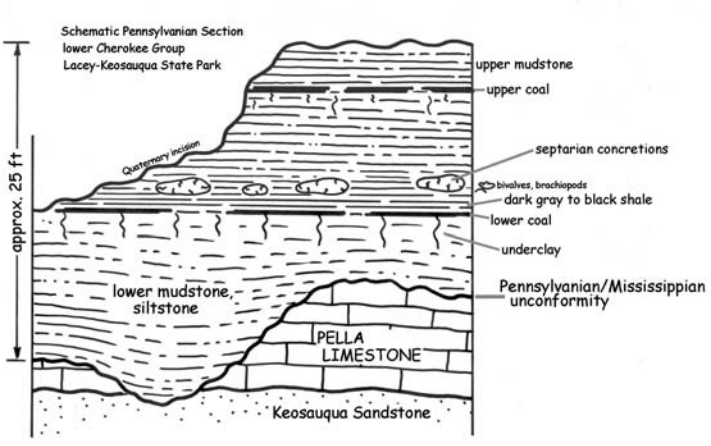

Figure 8. Graphic section of Pennsylvanian rocks exposed at Lacey-Keosauqua State Park.

Above this lower coaly horizon, an interval of gray to black shale is seen. Immediately above the coal in places, a fissile pyritic black shale occurs, some pieces of which show lighter colored

laminae (possibly phosphatic). Slightly higher, a thin interval containing scattered to common limestone concretions can be seen within the gray shale. These rounded concretions range from about 4 inches to over 2 feet in diameter, many showing crystalline calcite fracture fills within a mosaic of fractures along the outer rinds of the concretion. Such fractured limestone concretions are usually termed "septarian concretions." Some of the concretions are fossiliferous to varying degrees, and indeterminate bivalves (clams) and productid brachiopods (cf. *Desmoinesia*) are recognized.

The uppermost Pennsylvanian strata in the park are dominated by gray mudstones, with some siltstone. An upper coal horizon, over a weakly-developed underclay, occurs within this interval. The Pennsylvanian strata are deeply eroded in the park beneath unconsolidated Quaternary sediments. Most Pennsylvanian exposures are no more than a few feet thick, but a few cutbank outcrops in the park display 10 to 20 feet of section.

REFERENCES

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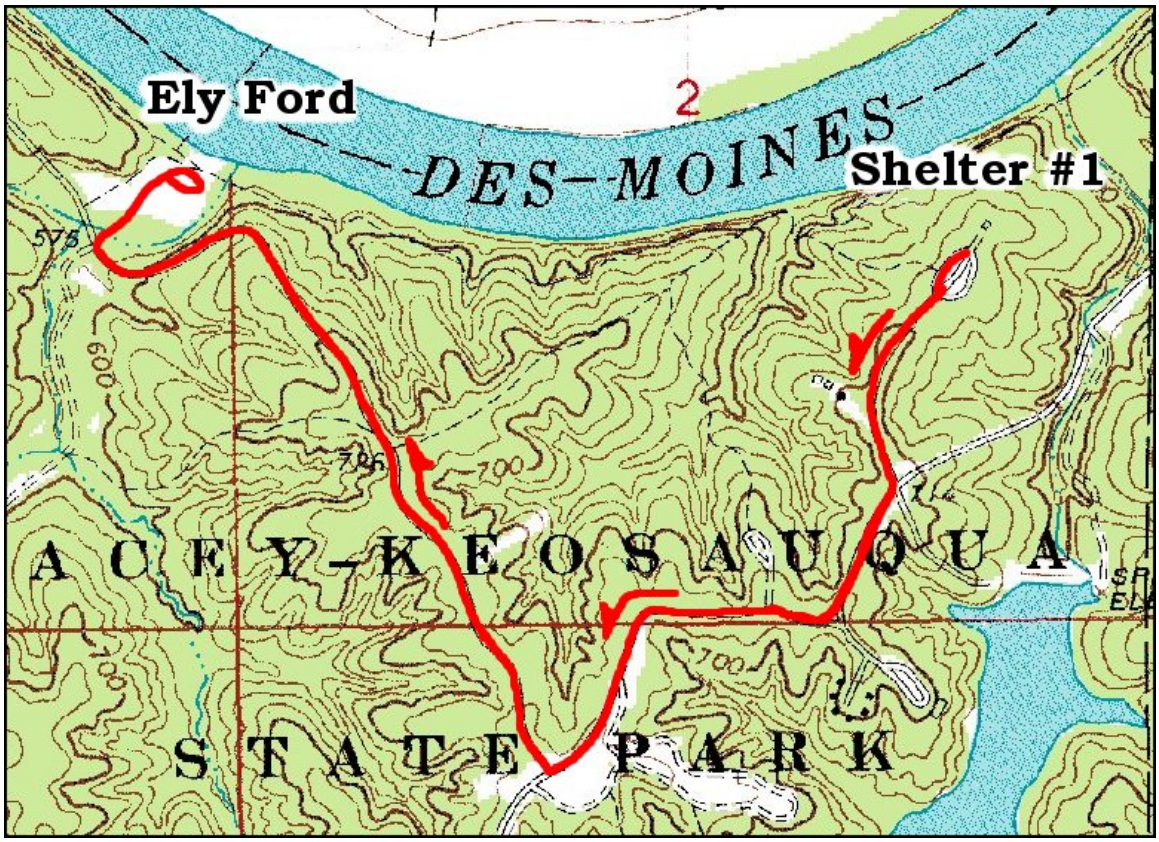
FIELD TRIP STOPS AT LACEY-KEOSAUQUA STATE PARK

Field trip begins at 10:00 am . . . . Shelter #1

Drive west along Lacey Trail Road past DNR office and campground

Turn right on Iris Trail Road and continue west

Turn right and continue north to Ely Ford



Map 1. Shelter #1 to Ely Ford

ELY FORD

Ely Ford is named for John Ely, an early settler in the area who built a cabin at this location in the 1830s. In this area, the Des Moines River runs on bedrock and can be easily forded under low-flow conditions. A boulder, plaque, and display describe the 1846 trek of thousands of Mormon settlers from Nauvoo to Salt Lake City (see article by Garvin, p. 25 of this guidebook). Although most of the 1846 Mormon emigrants took another route and did not cross the Des Moines at Ely Ford, later travelers may have.

At Ely Ford, Dr. Paul Garvin (Cornell College) will lead a discussion of the Mormon exodus through this area. We will then hike across the bridge over Ely Creek and continue a few hundred meters east along the river trial. Along the route, we will pass through a growth of 70 year old sugar maples and other trees. DNR naturalist John Pearson will discuss the history and significance of this area of forest. At **Field Trip Stop 1**, we will examine an exposure of

Mississippian Keosauqua Sandstone. A discussion of the exposure will be led by Dr. Brian Witzke (Iowa Geological Survey).

Then we will hike back to the parking area and down to Ely Creek for **Field Trip Stop 2**, where we will see more of the Keosauqua Sandstone, including interesting structures, concretions, and trace fossils. Finally, we will continue up Ely Creek, cross Ivy Avenue to the valley of Duckworth Creek, hike south along the mown trail, and then through the woods to **Field Trip Stop 3**, an exposure of Pennsylvanian mudstone channel-fill, cutting out most of the Mississippian Pella Formation, and the underlying St. Louis Formation strata.

Mormon Pioneer Migrations Across Southeast Iowa

Paul L. Garvin
Cornell College
Mount Vernon, Iowa

In the spring of 1846, Bringham Young and a group of Mormon families fled Nauvoo, Illinois, and headed west toward their ultimate homes in Salt Lake City, Utah. A monument at Ely Ford commemorates the thousands of Mormons that traveled the Mormon Trial on the long journey, noting that some of the families crossed the Des Moines River at this location. For a detailed account of the Mormon trek, *Mormon Pioneer Migrations Across Southeast Iowa*, page 25 of this guidebook.

Wildlife of the Lacey-Keosauqua State Park Area

Daryl Howell
Conservation and Recreation Division
Iowa Department of Natural Resources

Lacey-Keosauqua State Park is the home to a large and diverse population of wildlife. The park is especially known for its birds, with 166 species reported in the park and vicinity by Sandrock (1986) during five years of extensive birding in the early 1980's. Additionally, a variety of mammals, reptiles, and amphibians live in the park and surrounding areas. For a detailed discussion of the animals of the Lacey-Keosauqua, see *Wildlife of the Lacey-Keosauqua State Park Area*, beginning on page 39 of this guidebook.

Hike across the foot bridge over Ely Creek and east along the river trial, about 200 yards to Stop 1

Vegetation and Flora of Lacey-Keosauqua State Park

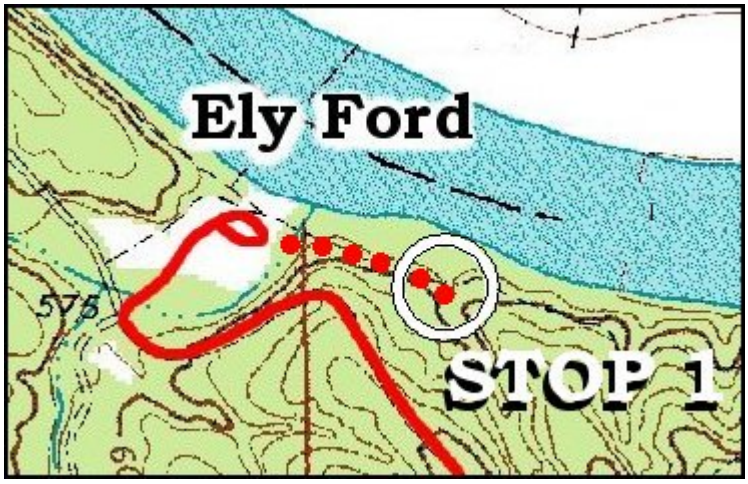
John Pearson
Conservation & Recreation Division
Iowa Department of Natural Resources

Along the hike to Stop 1 we will pass through one of the park's interesting forested areas. Iowa DNR Plant Ecologist John Pearson will discuss this area of the forest. For more information see *Vegetation and Flora of Lacey-Keosauqua State Park*, beginning on page 33 of this guidebook.

STOP 1: UPPER KEOSAUQUA SANDSTONE EAST OF ELY CREEK

Brian J. Witzke
Iowa Geological Survey
Iowa Department of Natural Resources

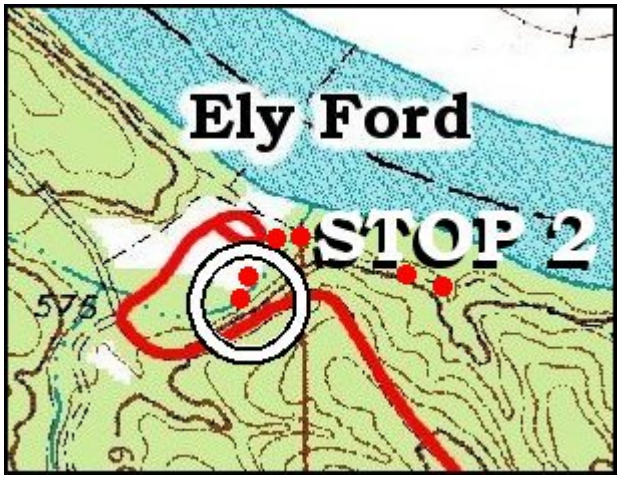
Field trip Stop 1 is located about 200 yards east of Ely Creek at Ely Ford, where the river trail crosses bedrock exposed at a drainage.



At **Stop 1,** we will see cross-bedded, well-cemented upper Keosauqua Sandstone of the Mississippian "St. Louis" Formation, exposed as a low escarpment in a minor drainage. Less well-cemented sandstones displaying burrows and other structures are visible below the upper unit. For more information see *Bedrock Geology of Lacey-Keosauqua State Park* on page 55 of this guidebook.

Stop 1. Exposure of Keosauqua Sandstone.

Hike back along the river trail, to Ely Ford and then down into the flood plain of Ely Creek to Stop 2.



STOP 2: KEOSAUQUA SANDSTONE AT ELY CREEK

Brian J. Witzke
Iowa Geological Survey
Iowa Department of Natural Resources

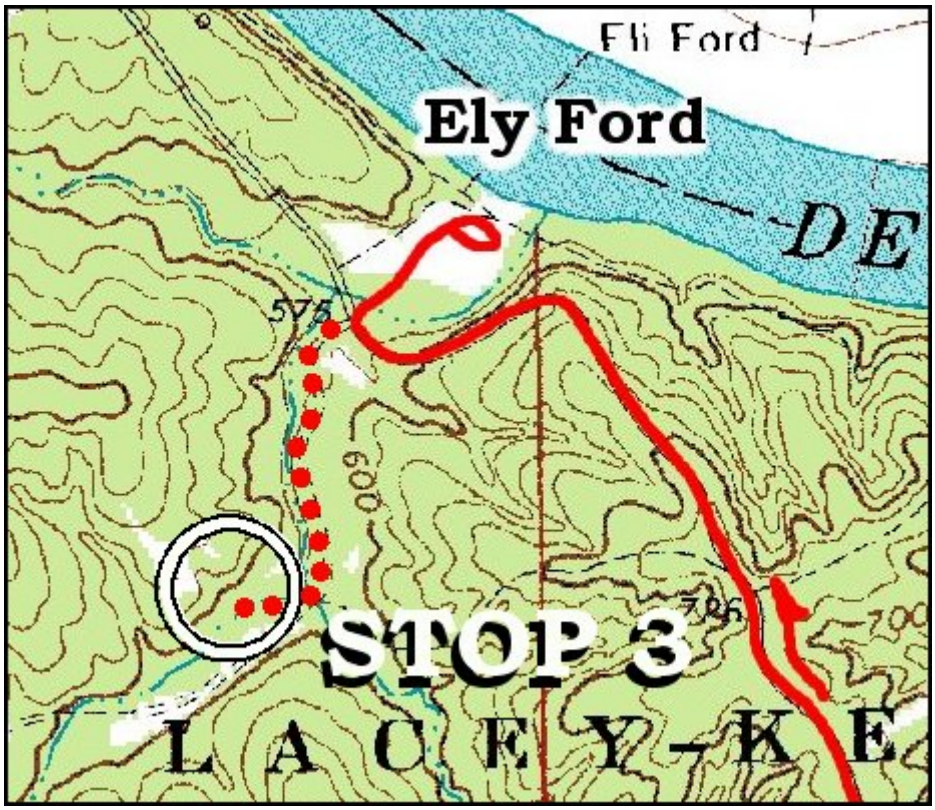
At **Stop 2,** we will see a bluff of the Keosauqua Sandstone (Upper Mississippian "St. Louis" Formation) just east of Ely Creek. The Keosauqua Sandstone at this stop displays large-scale channel-forms and troughs as well as fine horizontal laminations to low-angle cross-laminations. The unit also displays some more puzzling features including a variety of irregular carbonate nodules and fills, some are small (< 2 cm) and show considerable variation in abundance laterally and vertically in the sandstone, and some are quite large (up to 5-10 cm diameter, 10-30 cm long), forming vertical to sub-vertical burrow-like structures (see photos on page 61 of this guidebook). The identification of these structures is uncertain, resembling large burrows or rooting. It is possible that at least some of these concretions represent burrow fills, formed by aquatic organisms in an estuarine system. Some of the larger subvertical structures seen at Ely Ford resemble structures identified elsewhere as lungfish burrows. Although difficult to verify, it is noteworthy that lungfish fossils have been identified in upper "St. Louis" strata in Keokuk County. For more information see *Bedrock Geology of Lacey - Keosauqua State Park* on page 55 of this guidebook.

Stop 2. Keosauqua Sandstone along Duckworth Creek.

Hike south (upstream) along Ely Creek to the road, cross the creek on the road bridge

Note: the bridge over Duckworth Creek was constructed in 1937 by CCC workers from Mississippian Pella limestone quarried in Lacey-Keosauqua State Park. We will see the quarry at **Stop 6**.

Continue south of the road into the clearing that parallels Duckworth Creek. When the mowed clearing ends, follow the trip leaders into the wooded area, about 100 yards to Stop 3



STOP 3: PENNSYLVANIAN MUDSTONE CHANNEL AT DUCKWORTH CREEK

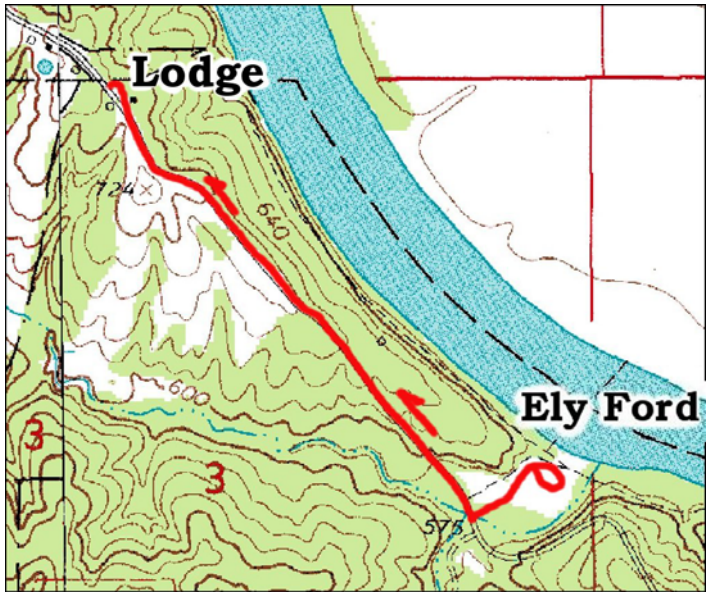
Brian J. Witzke
Iowa Geological Survey
Iowa Department of Natural Resources

At Stop 3, a Pennsylvanian Cherokee Group channel can be seen incised into the Mississippian Pella Limestone. The Pella's thickness has been reduced to a few centemeters by channel erosion, and "St. Louis Formation" strata can be seen below the Pella. In the photograph on the next page, the Pennsylvanian mudstone-dominated sediments are seen sitting on the light-colored Pella Limestone (below the hammerhead, and the Pella/ St. Louis contact is at the toe of the boot).

At this **Stop 3** exposure Pennsylvanian strata overlies Pella Fm limestone (contact at hammer head) over "St. Louis Fm" Verdi Mbr strata

Hike back down Duckworth Creek and return to the cars at Ely Ford.

Drive back to Iris Trail Road, turn right and continue northwest past the turnoff to Shelter #2 to the Lacey-Keosauqua Lodge for LUNCH.



THE LODGE AND GOLF COURSE AT LACEY-KEOSAUQUA STATE PARK

Raymond R. Anderson
Iowa Geological Survey
Iowa Department of Natural Resources

The oldest portion of the lodge at Lacey-Keosauqua State Park was originally the stone home of one of the area's early settlers, Sam Jackson. Jackson sold the house and his land to the State of Iowa and it became a part of the original state park, dedicated in 1921. The building was enlarged with the addition of a wooden structure retrieved from another area of the park. In 1937, the CCC added the large stone porch, constructed of Pella limestone quarried in the park. For more information see *History of Lacey-Keosauqua State Park, Van Buren County, Iowa* on page 3 of this guidebook.

The lodge at Lacey-Keosauqua State Park.

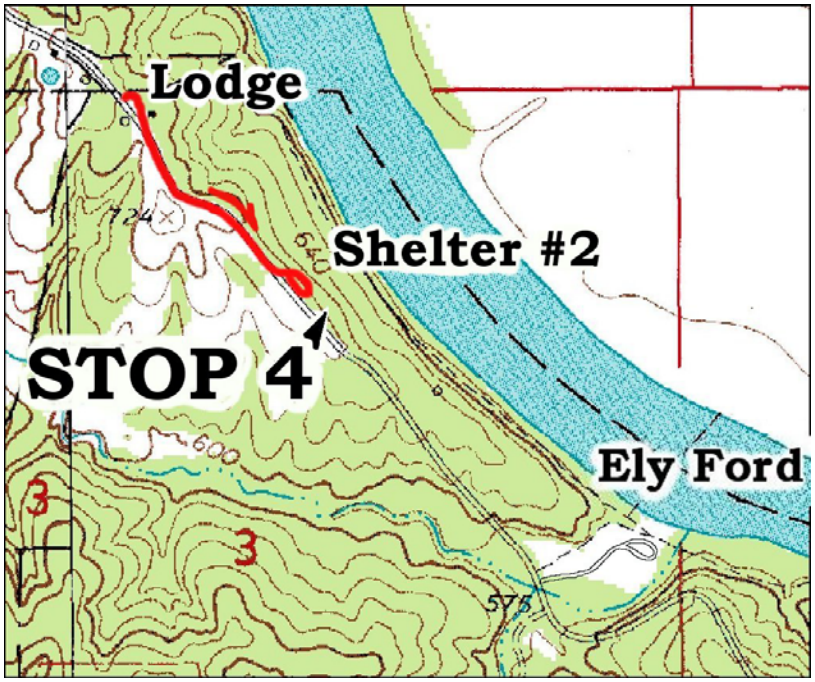
In May 1925, fifty-four area residents formed the Lacey-Keosauqua State Park Golf Course. It was carved out of the wooded area directly south of the lodge on the other side of the road. The lodge was remodeled by the CCC for use as a golf clubhouse. The golf course, considered one of the most challenging in Iowa, was used until the late 1960s when a new club and golf course was constructed in Keosauqua. The small prairie plot south of the lodge marks the former location of the first hole of the golf course. In 1990, the lodge and the area around it were listed in the National Register of Historic Places.

THE HONEY WAR

Raymond R. Anderson
Iowa Geological Survey
Iowa Department of Natural Resources

A granite boulder located on the northeast corner of the lodge at Lacey-Keosauqua State Park commemorates the Honey War, an early border dispute between the citizens of Van Buren County and the State of Missouri. The "war" was triggered by an incident that occurred in 1839 in what is now the park. In 1839, the Missouri governor sent agents into the disputed area (now southeastern Iowa) to collect taxes. On arriving in the village of Des Moines (now Keosauqua), the agents were driven back with clubs and pitchforks by the angry residents. On their way back to Missouri, the agents cut down several "bee trees" in what is now Lacey-Keosauqua State Park, recovering the honey as partial tax payment. Outraged by the treatment of his agents, the governor mustered 2,200 Missouri militiamen and sent them to enforce the tax order. The Van Buren County residents raised a posse who went into Missouri and kidnapped the Clark County Sheriff. Eventually, 1,200 Iowa irregulars were facing 2,200 troops of the Missouri militia across the Des Moines River. Cooler heads prevailed and no blood was spilled. In 1846 Iowa became a state, and soon after Congress drew the permanent state boundary. For more information see *The Honey War* on page 21 of this guidebook.

Return to cars and drive back (southeast) on Iris Trail Road about ½ mile to Lacey Trail Road and turn left (north) into the parking area at Shelter #2 for Stop 4.



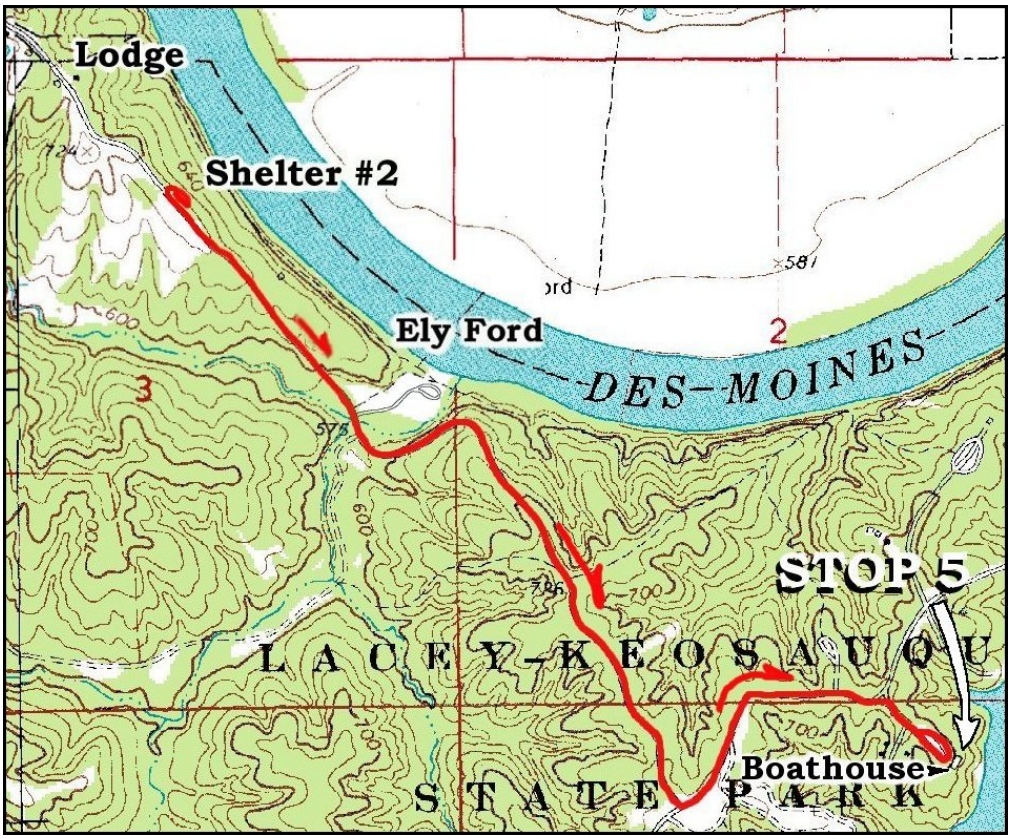
STOP 4: THE ARCHAEOLOGY OF LACEY-KEOSAUQUA STATE PARK

Joe Alan Artz
Office of the State Archaeologist
Iowa City, Iowa

Field Trip Stop 4 is located near park Shelter #2. At this stop we will have an opportunity to examine several Native American burial mounds and discuss their history and significance. Fifteen archaeological sites within Lacey-Keosauqua State Park are recorded with the University of Iowa's Office of the State Archaeologist. These include a shell midden, seven habitation or resource-processing sites, and five burial mound sites. The 15 sites provide tangible evidence that prehistoric Native Americans hunted, gathered, and lived in these bluffs overlooking the Des Moines River and that, for at least part of prehistory between 2,500 and 1,000 years ago, buried their dead in monumental earthworks. For more information see *The Archaeology of Lacey-Keosauqua State Park* on page 45 of this guidebook.

Return to cars, drive back to Iris Trail Road, drive (southeast) on about ½ mile to the intersection of Lacey Trail Road.

Turn left (northeast) on Lacey Trail Road and continue for about ½ mile to the road to the beach, turn right (southeast) and drive toward the park bathhouse and beach.



STOP 5: THE BATHHOUSE, THE BEACH, THE DAM, AND HISTORY OF LACEY-KEOSAUQUA STATE PARK

Raymond R. Anderson
Iowa Geological Survey
Iowa Department of Natural Resources

At **Field Trip Stop 5** we will have an opportunity to view some of the handiwork of the CCC (Civilian Conservation Corps) at Lacey-Keosauqua State Park. When the stock market crash of 1929 pulled the nation into deep depression, one of the "New Deal" programs enacted by President Roosevelt to relieve the massive unemployment was the CCC, a workforce organized to protect and develop the nation's natural resources. Their work included construction, maintenance, forestry, and the prevention of fire, floods, and soil erosion. Several CCC Companies were stationed in Keosauqua and worked in Lacey-Keosauqua State Park, beginning in 1933, constructing roads and trails, constructing houses, shelters, and other structures, building a lake and many erosion control structures, and performing a number of forestry projects.

One of the most impressive CCC structures in the park is the bathhouse. The building is 107 feet long and 25 feet wide, constructed from Pella Limestone quarried in the park and native log beams. The central concession area was flanked on the north with men's dressing room wing and on the south by a women's wing with showers, latrines, and washbasins. A stone patio on the south end of the bathhouse overlooks the beach 30 feet below. In 1990, the Lacey-Keosauqua bathhouse was listed in the National Register of Historic Places.

To provide bathers with access to the beach, the CCC constructed one of the most spectacular quarry stone stairways in any of Iowa's State parks. A cylindrical structure for renting boats was incorporated into the stairway.

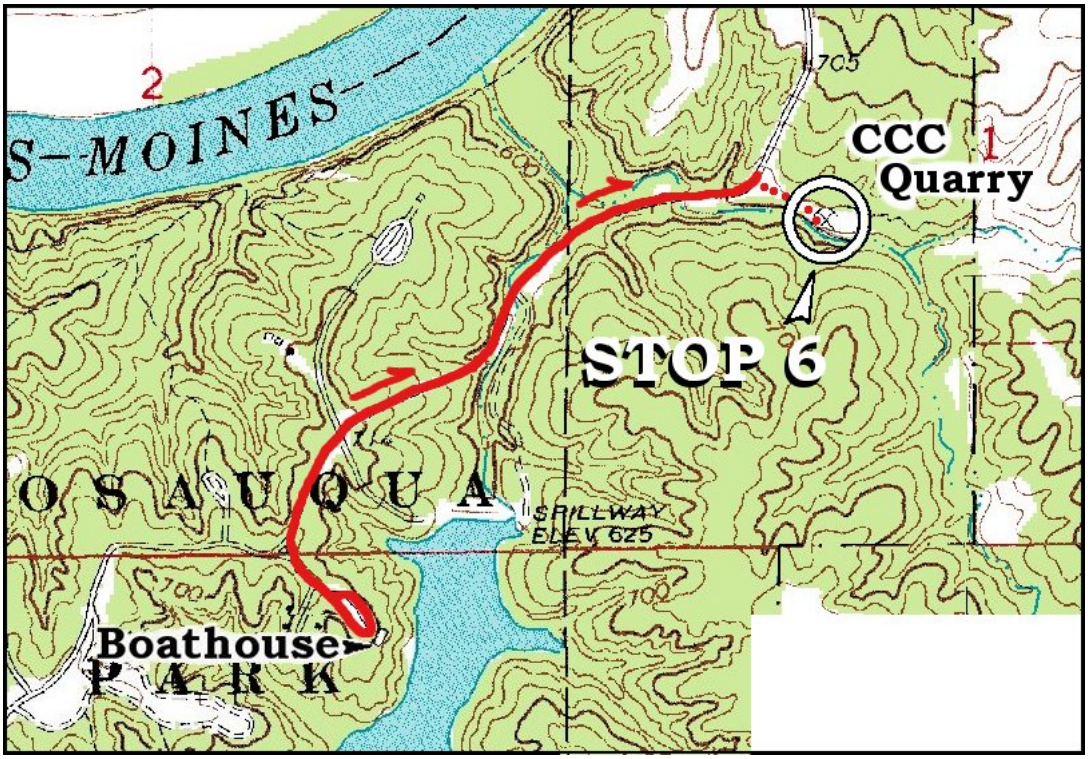
CCC Stone stairway leading from the bathhouse to the beach at Lacey-Keosauqua Lake.

The beach was constructed on the west side of the lake by carving out a hillside, removing 13,000 cubic yards of earth. This work was all done by hand, since the only CCC bulldozer was being utilized in the construction of the dam. The beach was finished by planting grass in the upper parts of the slope and covering the beach area with 1 inch of sand recovered from the Des Moines River.

Lacey-Keosauqua Lake was created in 1934 when the CCC dammed Thatcher Creek. The 22-acre lake reaches a maximum depth of 28 feet and a drainage basin of 2,122 acres, all within the park. A serious leak developed in the dam in 2002 necessitating a lowering of the lake by 9 feet to save and repair the dam.

Today, the bath- house is closed, but the beach is open for public swimming, although lifeguards are no longer present. For more information see *History of Lacey-Keosauqua State Park, Van Buren County, Iowa* on page 3 of this guidebook.

Return to the cars. **Take care to follow the field trip leader's instructions to Stop 6, parking will be difficult**. Drive back to Lacey Trail Road, turn right and continue northwest past the Park Manager's office and past the turnoff to Shelter #1 to the service road that leads to the CCC quarry. Park according to the trip leader's directions.



Follow the field trip leaders south on the trail to the CCC quarry, Stop 6.

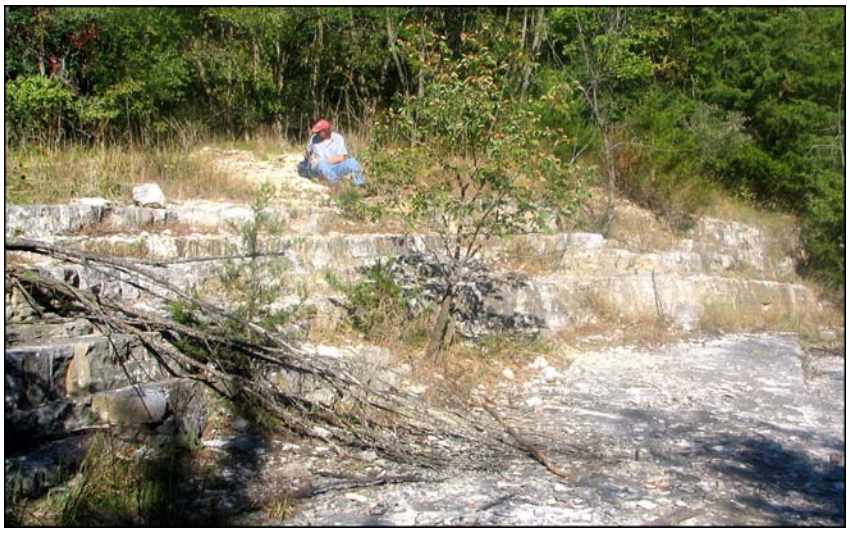
STOP 6: THE CCC QUARRY AND MISSISSIPPIAN EXPOSURES ALONG WESLEY CREEK

Brian J. Witzke
Iowa Geological Survey
Iowa Department of Natural Resources

CCC Quarry

CCC workers opened a quarry in the Mississippian Pella Formation limestone on the west bank of Wesley Creek, just upstream from the park road bridge. At the quarry site, the Pella varies in thickness from about 4 to 20 feet (resting unconformably on an erosional surface with up to 5 feet of erosional relief developed on upper Verdi and Keosauqua Sandstone strata and erosionally thinned near the creek). This quarry is one of the best- preserved CCC quarry in Iowa. To recover the stone, a thin cover of surface soil and loess was removed and the stone quarried using compressed air drills to bore a series of drill holes in the rock layers (see photo on page 7), then shooting the holes with dynamite to fracture the rock into pieces that were handled by the workers. Many of these drill holes are still evident in the quarry. The rocks were then dressed by hand to create the sizes and shapes needed for construction. Stone from this quarry was used in most of the structures in Lacey-Keosauqua State Park, with the exception of the old caretaker's house and the two shelters. For more information on the history of the quarry see *History of Lacey-Keosauqua State Park, Van Buren County, Iowa* on page 3 of this guidebook.

In the park and nearby areas of southeast Iowa, the Pella Formation is characterized by dense fossiliferous limestone, commonly in regular beds. Thin shales or shaly limestone separate some beds, and shaly interbeds generally increase upwards. Stylolites are scattered to common. To learn more about Pella geology see *Bedrock Geology of Lacey-Keosauqua State Park* on page 55 of this guidebook.

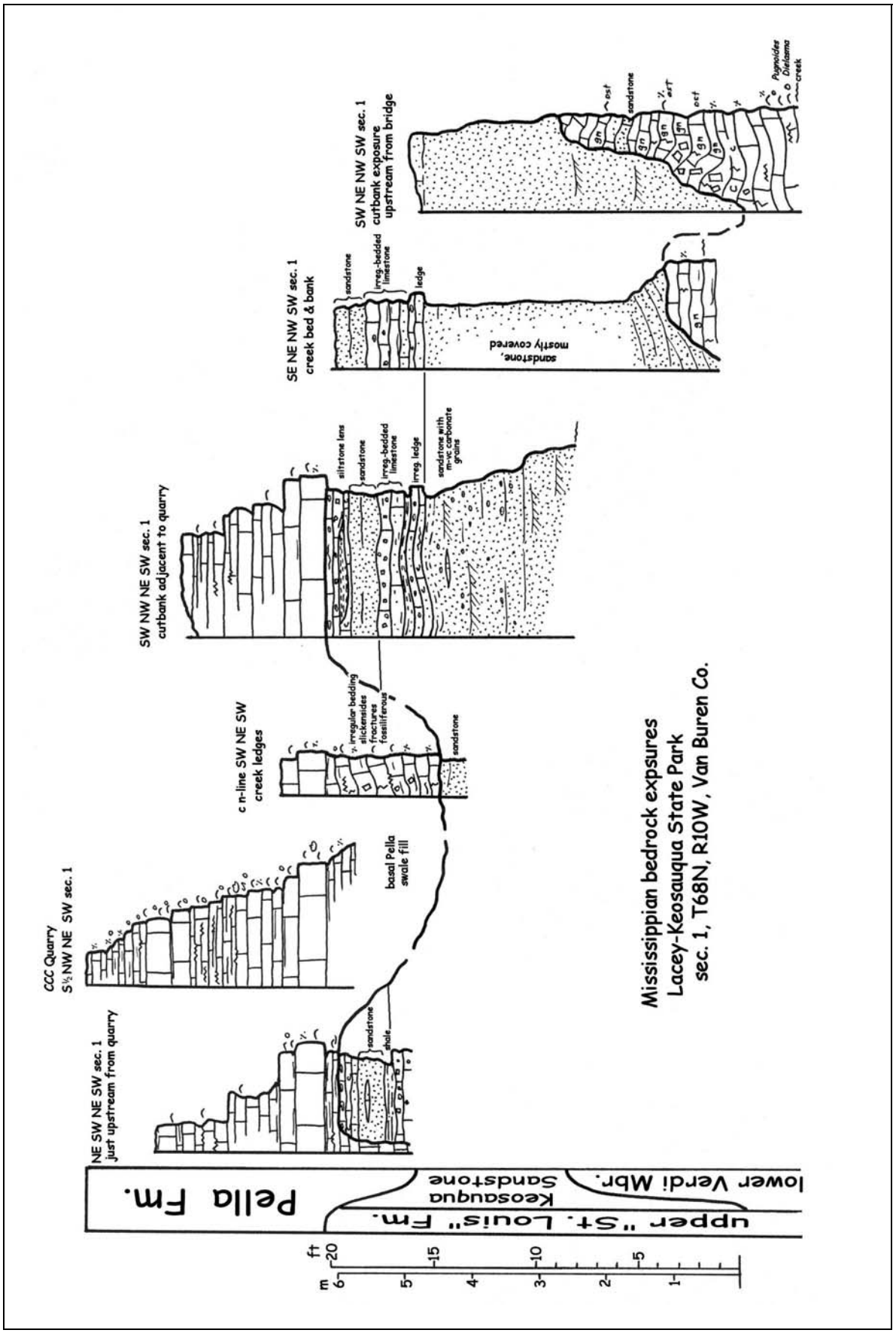


The CCC Quarry at Lacey-Keosauqua State Park.

Follow the field trip leaders south from the CCC quarry, to Pella and St. Louis Formation exposures along Wesley Creek near Lacey Trail Road.

Exposures Along Wesley Creek

An informative sequence of the Pella Formation and upper St. Louis Formation Verdi Member exposures can be observed along Wesley Creek near the CCC Quarry (see graphic sections on page 79). The Verdi Member is characterized by a complex and interbedded succession of dense limestone, dolomite, and sandstone. Lower Verdi strata seen in Lacey-Keosauqua Park include fossiliferous limestone and dolomite, green-clay mottled (some filling burrows) limestone and dolomitic limestone, dense limestone with calcite spots, and minor interbedded sandstone and siltstone. In many sections, these strata show irregular bedding in broad swales, with low to moderate dips; in places, the beds are fractured to slightly brecciated. The irregular bedding and brecciation likely resulted from evaporite solution collapse within the underlying Croton Member. The succession of beds in the lower Verdi of the park constrain a general shallowing-upward depositional sequence, with fossiliferous open-marine carbonate beds in the lower part, and more restricted shallow-marine to nearshore depositional facies upsection. For additional information about the St. Louis and Pella formations in the park see *Bedrock Geology of Lacey-Keosauqua State Park* on page 55 of this guidebook.

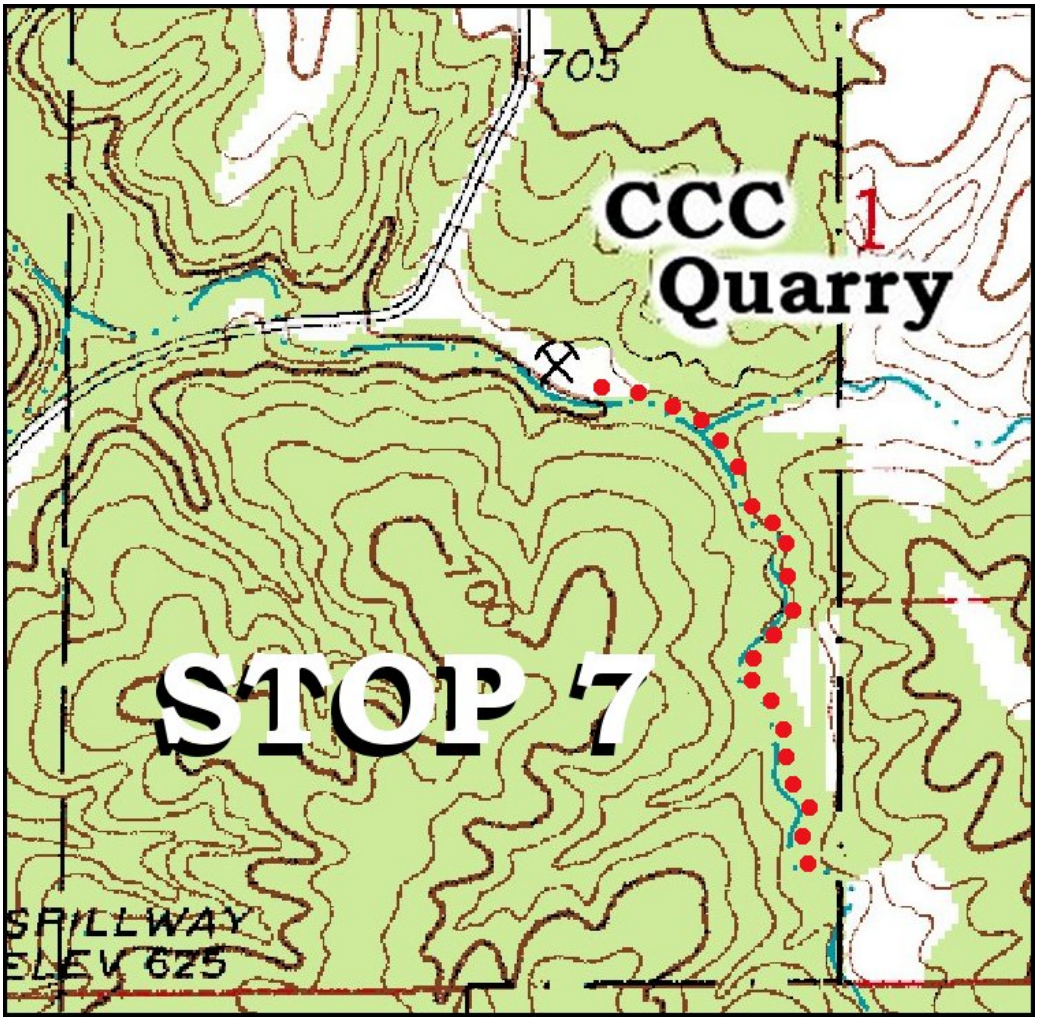

Mississippian bedrock expsures
Lacey-Keosauqua State Park
sec. 1, T68N, R10W, Van Buren Co.
Pella Fm.
Keosauqua Sandstone
upper "St. Louis" Fm.
lower Verdi Mbr.
ft
m
CCC Quarry
S½ NW NE SW sec. 1
NE SW NE SW sec. 1
just upstream from quarry
sandstone
shale
basal Pella swale fill
c n-line SW NE SW
creek ledges
irregular bedding
slickensides
fractures
fossiliferous
sandstone
SW NW NE SW sec. 1
cutbank adjacent to quarry
siltstone lens
sandstone
irreg.-bedded limestone
irreg. ledge
sandstone with m-vc carbonate grains
SE NE NW SW sec. 1
creek bed & bank
sandstone
irreg.-bedded limestone
ledge
sandstone, mostly covered
SW NE NW SW sec. 1
cutbank exposure
upstream from bridge
sandstone
Pugnoides
Dielasma
creek

STOP 7 (OPTIONAL): PENNSYLVANIAN EXPOSURES SOUTH ALONG WESLEY CREEK

Brian J. Witzke
Iowa Geological Survey
Iowa Department of Natural Resources

Field Trip Stop 7 is an optional stop that is only for participants who are able to traverse a little over 1 mile (round trip) of forested and overgrown terrain without the benefit of trails. Participants will view a variety of Pennsylvanian Cherokee Group lithologies in several exposures along Wesley Creek.

Follow the field trip leaders south from the CCC quarry, to St. Louis Formation exposures along Wesley Creek.

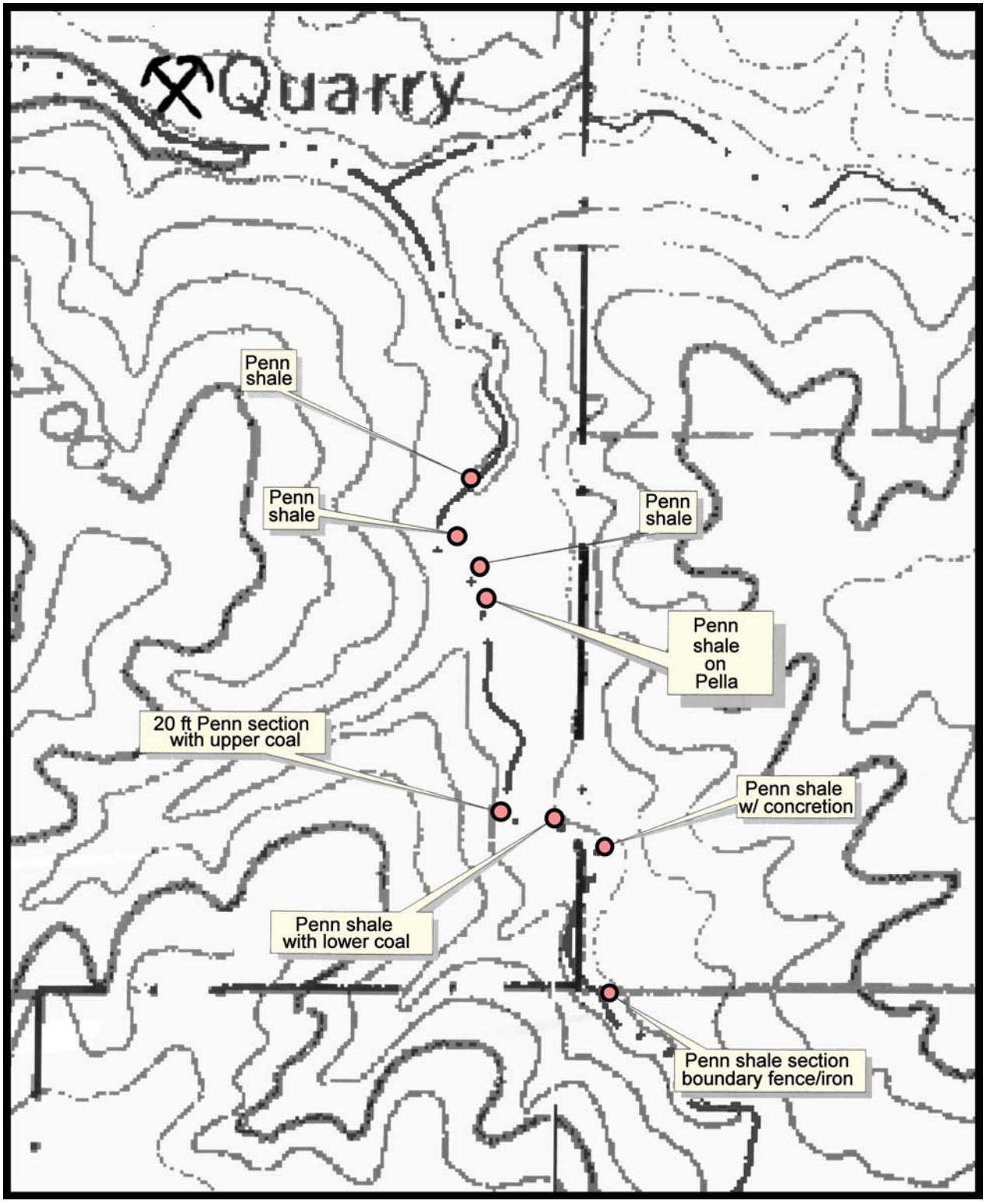


The succession of Pennsylvanian bedrock strata in Lacey-Keosauqua Park is not particularly well displayed, but a general succession can be pieced together from exposures in the park (especially along Wesley Creek). A map locating Pennsylvanian exposures along Wesley Creek can be found on page 82 of this guidebook. A lower interval of gray mudstone and siltstone is seen in places to overlie the eroded Pella Limestone, locally resting as low as the upper Keosauqua Sandstone. The upper part of this lower unit is locally seen to be modified by ancient soil-forming processes, shown by color changes (pale to reddish), abundant slickensides, and rooting. These clay-rich paleosols are often termed "underclays," as they commonly underlie coals. In the park, this underclay is capped by a thin coal to coaly shale.

Above this lower coaly horizon, an interval of gray to black shale is seen. Immediately above the coal in places, a fissile pyritic black shale is seen, some pieces of which show lighter colored laminae (possibly phosphatic). Slightly higher, a thin interval containing scattered to common limestone concretions can be seen within the gray shale. These rounded concretions range from about 4 inches to over 2 feet in diameter, and many show crystalline calcite fracture fills within a mosaic of fractures along the outer rinds of the concretion. Such fractured limestone concretions are usually termed "septarian concretions." Some of the concretions are fossiliferous to varying degrees, and indeterminate bivalves (clams) and productid brachiopods (cf. *Desmoinesia*) are recognized.

The uppermost Pennsylvanian strata in the park are dominated by gray mudstones, with some siltstone. An upper coal horizon, over a weakly-developed underclay, occurs within this interval. The Pennsylvanian strata are deeply eroded in the park beneath unconsolidated Quaternary sediments. Most Pennsylvanian exposures are no more than a few feet thick, but a few cutbank exposures in the park expose 10 to 20 feet of section. For additional information and a representative graphic section of Pennsylvanian geology in the park see *Bedrock Geology of Lacey-Keosauqua State Park* on page 55 of this guidebook.

Pennsylvanian exposures along Wesley Creek in Lacey-Keosauqua State Park.

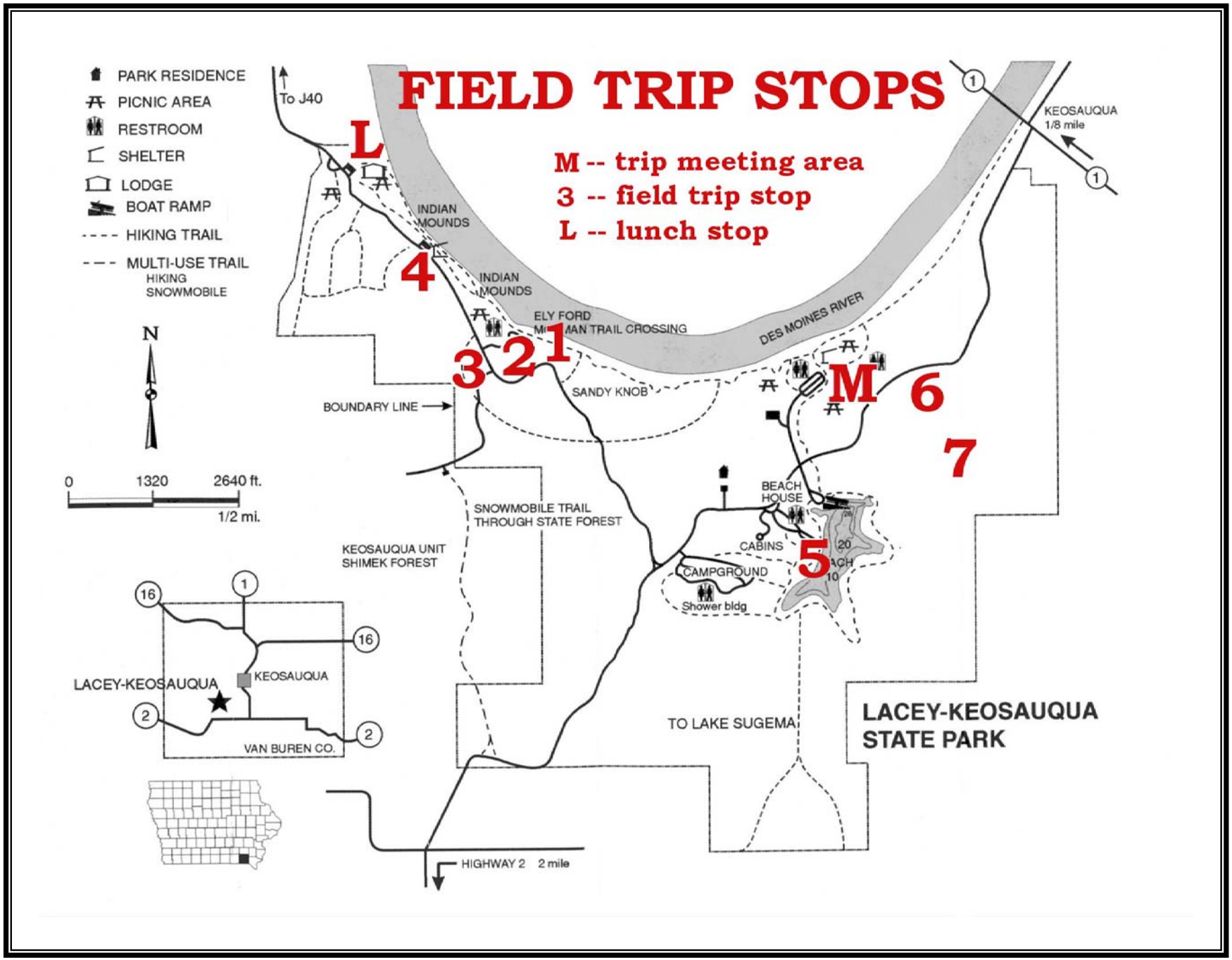

Quarry
Penn shale
Penn shale
Penn shale
Penn shale on Pella
20 ft Penn section with upper coal
Penn shale w/ concretion
Penn shale with lower coal
Penn shale section boundary fence/iron

Following the end of the field trip, participants are welcome to join trip leaders and others in the Dining Hall at the VFW Vet's Club at 202 Van Buren Street in Keosauqua (see map below) for libations and discussion of the field trip, Iowa Survey mapping projects, and other topics. Everyone is welcome to join us with questions, comments, or just to hang out.

At a little before 6:00 pm those who have registered for the GSI Fall Banquet and Business Meeting will walk down the street to the Hotel Manning, at 100 Van Buren Street.

The trip leaders wish to thank all of the trip participants for joining us today for this interesting and informative examination of the Natural History of Lacey-Keosauqua State Park. **Have a safe Trip Home.**

Geological Society of Iowa
109 Trowbridge Hall
Iowa City, Iowa 52242-1319
http://www.igsb.uiowa.edu/gsi


FIELD TRIP STOPS
M -- trip meeting area
3 -- field trip stop
L -- lunch stop
PARK RESIDENCE
PICNIC AREA
RESTROOM
SHELTER
LODGE
BOAT RAMP
HIKING TRAIL
MULTI-USE TRAIL
HIKING
SNOWMOBILE
To J40
KEOSAUQUA
1/8 mile
INDIAN MOUNDS
INDIAN MOUNDS
ELY FORD
DES MOINES RIVER
SANDY KNOB
BOUNDARY LINE
SNOWMOBILE TRAIL THROUGH STATE FOREST
KEOSAUQUA UNIT SHIMEK FOREST
BEACH HOUSE
CABINS
CAMPGROUND
Shower bldg
TO LAKE SUGEMA
LACEY-KEOSAUQUA STATE PARK
HIGHWAY 2 2 mile
N
0 1320 2640 ft.
1/2 mi.
LACEY-KEOSAUQUA
KEOSAUQUA
VAN BUREN CO.
L
4
3
2
1
M
6
7
5